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HILL COUNTRY SHEEP-FARMING IN THE NORTH ISLAND.

AN ECONOMIC STUDY OF EAST COAST FARMS.

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IT is intended in this article to discuss on broad lines some of the features of hill country sheep-farming in the North Island under the following headings: (1) Stocking system, (2) disposal of stock, (3) gross returns from the several commodities, (4) expenses of working and management, (5) capital position, (6) seasonal price fluctuations and results.

The district in which the farms under review are situated is broadly known as the "East Coast"; the counties concerned are Matakaoa, Waiapu, Waikohu, Uawa, Cook, and Wairoa. This area is looked upon as one of the favoured hill-country sheep districts of New Zealand. The nature of land is fairly uniform throughout, as is illustrated by the type of pasture which it carries. It has all at one time carried English grasses, and although to some extent—and in some localities more than in others—the better type of pasture still persists, native grass has become the dominant feature over the greater portion and is steadily increasing. In seasons of plentiful and well-distributed rainfall, rye-grass, cocksfoot, and white clover increase the proportion of high-class fodder available. It is evident that these grasses could be rejuvenated by systematic top-dressing, but it is questionable whether this class of country can be held economically on a large scale by the use of artificial fertilizers. The use of heavy cattle, which is an integral part of the farm management of this land, tends to hold the better grasses and to clean up the country generally. Despite the skill with which this living implement is used, however, cattle alone will not permanently hold rye-grass on country from which fertility is being constantly removed in the form of meat and wool.

The whole of the hill country of this favoured district, in company with the rest of the hill country of New Zealand, is going through, or has gone through, what is commonly known as a "deterioration"

stage from an English grass sward to a mixture of English and native grasses where eventually danthonia will be the dominant feature of the pasture association.

The information used in this study was supplied by the owners concerned in the form of copies of the station accounts kept by competent accountants. A considerable number of the farms were visited personally, the whole district being very familiar to the writer. The accounts studied cover a period of five seasons—namely, from 1921–22 to 1925–26. These years represent a good range of price conditions, including as they do two bad seasons, one medium season, and two high-price seasons. Thus the average of the whole gives a fair indication of the merits of the hill-country sheep industry in this district.

Stocking System.

Sheep.—The system of stocking adopted on farms of the type under discussion is of a uniform nature, fluctuating in the proportion of stock classes carried according to the state of pastures predominating. It is a generally accepted fact that the greater the proportion of ewes in the flock the more profitable the farm is likely to be. Table 1 indicates the ability of the farmer to sell a greater proportion of his lambs as fats and stores on land of high ewe-capacity. The percentage wintered as hoggets decreases, and practically the whole of the wethers are cleared as two-tooths.

Table 1.—Farms grouped according to Ewes wintered, showing Percentage of Stock Classes.

1	2	3	4	5	6	7	8	9
Ewe Range.	Number of Farms.	Ewes.	Hoggets.	Wethers.	Rams.	Total.	Sheep Class.	Ratio of Classes to Ewes (Average).
Per Cent.		Per Cent.	Per Cent.	Per Cent.	Per Cent	Per Cent.		
41/50 ..	4	47·76	35·16	15·80	1·28	100·00	Ewes ..	100·00
51/60 ..	17	55·27	35·80	7·52	1·41	100·00	Hoggets	63·39
61/70 ..	2	63·82	31·57	2·22	2·39	100·00	Wethers	16·72
71/80 ..	1	71·35	26·07	0·67	1·91	100·00	Rams	2·75
Average	24	55·48	34·42	8·56	1·54	100·00	Total	182·86

Undoubtedly the surplus available for interest after working-expenses and management salary are met is greater per unit of area than is the case on low ewe-capacity land. The group of four farms of 41/50 per cent. ewe-capacity average an interest surplus of £47·13 per 100 acres. For the group of seventeen farms of 51/60 per cent. ewe-capacity the surplus rises to £60·21 per 100 acres. The remaining two groups do not represent sufficient farms to be taken as reliable, but they do show slight advances over the lower ewe-intensity groups.

Cattle.—It is not to be expected that the number of cattle carried will show a correlation with returns, as the variations between farms hide any effect that cattle may have. To gauge this effect it would be necessary to have strictly comparable farms on some of which cattle were not kept. Over the twenty-four farms cattle-intensity

varies from 1 to 29 to 1 to 7 sheep, with an average of 1 to 12. Of the total cattle kept, 44 per cent. represents breeding-cows, while the remainder represents mixed classes of varying ages.

Disposal of Stock.

The exact numbers of different classes of stock disposed of are difficult to obtain over a range of farms, as the data are not sufficiently detailed in the farmers' accounts. From the information available the sales per hundred sheep wintered—allowing for a 7 per cent. death-rate and 4 per cent. killed for station consumption—are approximately as follows :—

Class.	Number.
Ewes (cull two-tooth or sound full-mouth)	10·0
Lambs	7·6
Hoggets (two-tooth or as rising two-tooth)	11·9
Wethers (rising four- or six-tooth)	6·5
Total	36·0

As previously indicated, sheep-sales are likely to fluctuate above or below this average according to the proportion of ewes carried. In addition to sheep-sales during normal seasons, an average of approximately two cattle beasts are sold per hundred sheep wintered.

Gross Returns.

In studying production and costs on sheep-farms of this type the best bases of comparison are area of holdings and total sheep carried, as the fluctuations in returns and working-expenses are influenced by these factors rather than by intensity of carrying-capacity. In the case of the twenty-four farms under consideration area and size of flock give the same grouping of farms. Therefore in the following tabulations area grouping only has been used.

Owing mainly to the fact that small farms are as a rule of better quality and may be given close supervision with relative ease, carrying-capacity increases as the area of the average farm decreases, as shown in Table 2 (col. 4). On an area basis the number of

Table 2.—Farms grouped according to Area, showing Stock, &c.

1	2	Per 100 Acres.			Per 1,000 Sheep.	
Area Range.	Number of Farms.	3 Average Area of Farms.	4 Sheep wintered.	5 Cattle wintered.	6 Area.	7 Cattle wintered.
Acres.		Acres.			Acres.	
5,000/14,999 ..	8	9,921	133·46	13·97	749	104·7
2,000/4,999 ..	8	3,279	141·67	12·00	706	84·7
300/1,999 ..	8	1,281	157·90	13·19	633	83·5

cattle carried does not vary considerably (col. 5), but when considered in relation to sheep carried the number decreases with area or as sheep-carrying capacity increases (col. 7).

The reflection of carrying-capacity increase on farms of smaller areas is apparent in returns from sheep and wool (Table 3, A, cols. 4 and 6). When considered on the basis of one thousand sheep, total returns show an increased production per sheep unit, the only commodity showing a decreasing tendency being cattle.

Table 3.—Farms grouped according to Area, showing Gross Returns.

A = per 100 acres; B = per 1,000 sheep.

1 —	2 Area Range.	3 Number of Farms.	4 Sheep.	5 Cattle.	6 Wool.	7 Sundry.	8 Total.	9 Area per 1,000 Sheep.
	Acres.		£	£	£	£	£	Acres.
A	5,000/14,999	8	44·20	11·90	55·40	0·90	112·40	..
	2,000/4,999	8	57·54	10·59	54·93	1·20	124·26	..
	300/1,999	8	60·12	10·29	69·86	1·59	141·86	..
B	5,000/14,999	8	331·05	89·13	414·95	6·74	841·87	749
	2,000/4,999	8	406·23	74·77	387·80	8·47	877·27	706
	300/1,999	8	380·56	65·14	442·21	10·06	897·97	633

It will be seen that on farms of this type the returns from wool are of great importance, being responsible for almost 50 per cent. of the total gross income. As time goes on, and pasture deterioration makes itself more acutely felt, wool is likely to occupy an even more important position than it does at present. This being the case, it is imperative that every effort be made to produce a commodity of even quality likely to realize the highest price compatible with farm-management conditions prevailing on hill country where fat lamb and mutton ceases to be the major consideration. The percentage of gross returns represented by each commodity is shown in Table 4.

Table 4.—Farms grouped according to Area, showing Percentage of Gross Returns contributed by Commodities specified.

1 Area Range.	2 Number of Farms.	3 Sheep.	4 Cattle.	5 Wool.	6 Sundry.	7 Total.
Acres.		Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
5,000/14,999	8	39·33	10·59	49·28	0·80	100·00
2,000/4,999	8	46·31	8·52	44·21	0·96	100·00
300/1,999	8	42·38	7·25	49·25	1·12	100·00

Expenses of Production.

It is to be expected that working-costs should fluctuate, no matter on what base they are considered. Especially is this the case for repairs and maintenance and sundry expenses.

Although small farms give the greatest gross return, both for a given area and for sheep, the advantage thus gained is, under the conditions of analysis used, lost in the cost of working such areas. It will be seen from Table 5 that, with the exception of rates, all costs tend to increase as the area decreases, resulting in a total cost

Table 5.—Farms grouped according to Area, showing Working-expenses.
A = per 100 acres; B = per 1,000 sheep.

1	2	3	4	5	6	7	8	9	10
—	Area Range.	Number of Farms.	Rates.	Shearing.	Stores.	Repairs and Maintenance.	Wages and Salary.	Sundry.	Total.
	Acres.		£	£	£	£	£	£	£
A	5,000/14,999	8	7·00	4·70	4·00	5·77	15·33	9·53	46·33
	2,000/4,999	8	6·12	5·57	6·15	4·77	22·02	13·00	57·63
	300/1,999	8	6·53	5·59	8·42	8·53	27·02	13·97	70·06
B	5,000/14,999	8	52·43	35·20	29·96	43·22	114·82	71·38	347·01
	2,000/4,999	8	43·21	39·32	43·42	33·67	155·46	91·78	406·86
	300/1,999	8	41·33	37·91	53·29	54·02	171·03	85·89	443·47

considerably higher than in the first group. This to a great extent is due to the salary standard allowed, and will be discussed at a later stage.

The increased cost of working and management is clearly shown in Table 6. When total cost per sheep is interpreted in capital represented, the care which must be taken in buying land is indicated. The earning-value of land does not increase proportionately with carrying-capacity if the area is small and the number of sheep to be carried is low. In the case of high-capacity land in large areas this point is not so important.

Table 6.—Farms grouped according to Area, showing Expenses and Capital represented per Sheep on a 7-per-cent. Basis.

Classification of Expense.	15,000/6,000 Acres.		5,000/2,000 Acres.		1,999/300 Acres.	
	Per Sheep.	Capital represented.	Per Sheep.	Capital represented.	Per Sheep.	Capital represented.
1	2	3	4	5	6	7
	s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.
Rates	1 0½	0 14 5¼	0 10¼	0 12 2	0 9¾	0 11 5
Shearing	0 8½	0 10 2½	0 9½	0 11 3	0 9	0 10 11
Stores	0 7¼	0 8 8¼	0 10½	0 12 6	1 0¾	0 15 1
Repairs and maintenance	0 10¼	0 12 5½	0 8	0 9 7¼	1 1	0 15 8
Wages and salaries ..	2 3½	1 12 10¾	3 1¼	2 4 6	3 5½	2 9 0¼
Sundry	1 5¼	1 0 5¾	1 10	1 6 2½	1 8½	1 4 7½
Total ..	6 11¼	4 19 1¾	8 1½	5 16 2¾	8 10½	6 6 8½

Rates.—Local bodies' rates is the only item of expense which shows uniformity of decline in sympathy with area. The reason for this is not clear. As the smaller farms have a higher carrying-capacity per acre, it appears at first glance that large holdings are carrying an undue proportion of local-body taxation. From the economic viewpoint the position is sound, as the owner's living surplus is materially

lower after working-expenses and interest have been paid. The variation in rates is from 1s. 0½d. to 9¾d. per sheep (cols. 2, 4, 6, Table 6). The capital represented by rates on a 7-per-cent. capitalization is shown in cols. 3, 5, 7. Local-body rates represent approximately 10 per cent. of the total working-expenses.

Shearing.—Shearing-costs cover all labour employed expressly for shearing, and the keep of the extra staff. In addition to these expenses there are items such as wool-packs, twine, marking-ink, oil and benzine, repairs to machinery, &c., which may justly be charged to shearing, but as these items are mixed with "Sundry" and "Repairs and maintenance" their cost cannot be correctly gauged. The tendency is for shearing-costs to rise as the size of the farm decreases. This is to be expected, as loss of time through bad weather, time taken to get started, and in moving, becomes heavy where small flocks are kept. This tendency is counterbalanced by the fact that on very small farms much of the work is done by the owner; otherwise the rise in cost per sheep would be more noticeable. The cost per sheep and the capitalization of cost is shown in Table 6. Shearing-costs represent approximately 9·4 per cent. of the total working-expenses.

Stores.—This item includes all station kitchen stores and meat, plus an allowance for stores consumed by the manager. Where no manager is employed an allowance has been made equal to that allowed for stations where a manager is kept. Where the owner lives on the station and still employs a manager household stores for the family have been excluded. This is one of the items of expense which shows considerable increase, on a per-sheep basis, as area decreases (from 7½d. in col. 2 to 1s. 0¾d. in col. 6). When capitalized this increase becomes very apparent. On the average, stores account for approximately 10·5 per cent. of the total expenses.

Repairs and Maintenance.—Repairs and maintenance are naturally a fluctuating expense, including as they do cost of fencing and repairs, scrub-cutting, grass-seed and sowing, and general repair work of all descriptions. These expenses also fluctuate from year to year and more on some farms than on others, being to some extent controlled by the state of prices ruling for primary products. They account on the average for approximately 11 per cent. of the total expenses.

Wages and Salary.—As previously indicated, the question of management reward presents difficulties. Whole-time managers are employed on 50 per cent. of the farms, the others being managed by the owners. The actual cost of labour on those farms under a manager is higher than is the case on owner-managed farms. Especially is this the case on small farms of two thousand sheep or less where very little outside labour is employed. Where small farms are run by hired labour (the owner not living on the farm) the cost per sheep is high, as is to be expected. The larger the flock the greater the scope for efficient labour-management.

For the purpose of tabulation it is essential that all farms be debited with labour costs. To effect an equal allocation the actual management salary paid has been omitted wherever it occurs, and a salary allotted according to the number of sheep wintered. It is not

suggested that the amount allowed represents the farmer's idea of a reasonable living-wage in every case. It must be recognized that on small flocks the management surplus will be low, and probably affords but an inferior living standard for the owner and family. At the same time the amount allowed is heavier per sheep on small farms than it is on large areas, and thus reflects the economic effect of labour costs on small holdings. It will be seen from Table 6 that on the standard of management allowed the cost of wages and labour per sheep increases from 2s. 3½d. to 3s. 5½d., thus stressing the undue weight of management on small flocks. This is a most important feature to remember in considering small sheep holdings of this type. If the whole of the work is done by the owner, flocks of under one thousand sheep cannot afford a high management salary. The fact of the comparatively high prices realized for small farms but accentuates the difficulty. Wages and salary on this basis represent approximately 37·1 per cent. of the total working-expenses. The scale of management salary allowed is as follows:—

	£
300 to 1,000 sheep	125
For every 500 sheep up to 5,000, £25 additional, or £325 for 5,000 sheep.	
5,000 to 6,000 sheep	350
6,000 to 7,000 sheep	375
7,000 to 10,000 sheep	400
10,000 to 15,000 sheep	450

Sundry Expenses.—This item includes insurance, shoeing, cartage, depreciation, oil, benzine, &c., and is a fluctuating amount representing an average of approximately 21 per cent. of the total working-expenses.

Interest and Profit.

Although the farm accounts analysed show a capital account they are not all computed on the same base, and are therefore not comparable. To establish an equable comparison between groups it is essential that interest charges be standardized on a uniform scale. In some instances the land is leased, and stock, plant, and improvements only are shown in the capital account. In other cases the mortgages shown are too heavy, which, when taken in conjunction with private capital, gives a capital investment considerably above the earning-limits of the land. The practice of placing profits to capital has in some accounts raised the personal capital above that which is actually employed in farming operations. For the purpose of establishing a uniform interest charge, total stock units carried have been taken as the base and capitalized at £4 per stock unit (*i.e.*, total sheep plus cattle, one cattle beast being taken as equivalent to seven sheep). This method reflects as nearly as possible the carrying-capacity of each farm, and approximates a value per sheep of £5 for land and improvements. By adopting this method a profit or loss is shown which becomes comparable between groups of farms. It may be considered that the scale of capitalization used is not high enough. If so it may be altered to suit individual cases, but the fact remains that even on this figure the surplus as profit is very small indeed, and the average farm cannot show reasonable interest on a higher capitalization.

When capital computed on this basis is charged with interest at 7 per cent. the position is as follows:—

Table 7.—Farms arranged according to Area, showing Interest and Profit per Thousand Sheep.

1	2	3	4	5	6	7
Area Range of Groups.	Number of Farms.	Gross Returns.	Working-expenses and Management.	Interest on Capital at 7 per Cent.	Profit.	Land-tax.
Acres.		£	£	£	£	£
5,000/14,999	8	841·87	347·01	484·97	9·89	62·64
2,000/4,999	8	877·27	406·86	446·09	24·32	13·17
300/1,999	8	897·97	443·47	443·10	11·40	5·20

It will be seen from Table 7 that profit per thousand sheep wintered is greatest on farms of medium size (col. 6). Up to the present stage land-tax has been ignored, but, as shown in column 7, its importance is clearly indicated.

The capital position is shown from a different angle in Table 8.

Table 8.—Farms grouped according to Area, showing Earning-capacity per Sheep wintered and per Acre.

1	2	3	4	5	6	7	8
Area Range of Groups.	Number of Farms.	Interest Surplus.	Total Capital represented at 7 per Cent.	Capital Value of Land and Improvements.	Value of Land and Improvements per Sheep.*	Value of Land and Improvements per Acre.*	Sheep wintered per Acre.†
Acres.		£	£	£	£ s. d.	£ s d.	
5,000/14,999	8	494·86	7,069	5,346	5 6 9	7 2 9	1·33
2,000/4,999	8	470·41	6,720	5,097	5 1 11	7 4 5	1·41
300/1,999	8	454·50	6,493	4,876	4 17 4	7 14 1	1·57

* Unweighted. † Weighted.

Interest surplus shown in col. 3 represents the difference between gross receipts and working management expenses for the respective groups. Total capital (col. 4) represents the interest surplus capitalized at 7 per cent. From this amount is subtracted the value of stock and plant, which leaves net value of land and improvements on which 7 per cent. interest has been earned after working-expenses have been met and a standard management salary allowed. Cols. 6 and 7 show this amount interpreted per sheep and per acre. Once more the effect of added cost per sheep in the case of small flocks is shown.

The percentage increases in value of land and improvements per acre for the three groups, taking the first as 100, are 101·4 and 107·7 respectively. The increases in sheep carried for the same groups are 106 and 118 per cent., showing that the value of land (provided the standard of management reward be considered reasonable) does not increase in a uniform ratio with carrying-capacity.

Seasonal Fluctuations and Results.

The foregoing analysis illustrates the average position on sheep-farms of this nature over a period of five years. Taking the long-time

view, the farmer is able to earn a living-wage varying in extent according to the size of his business, and if the capitalization of his enterprise is reasonable then he may earn in addition fair interest on his own money after meeting his mortgage liabilities. As indicated in previous tables, the rate of interest earned on his personal capital depends entirely on his equity in the farm and on total capitalization. If 7 per cent. is considered a reasonable amount to expect, then, on the average, capitalization per sheep or per acre must be considerably lower than that claimed or expected at the present time.

During years of high prices one often hears of the profits from large pastoral properties. Undoubtedly, on large holdings with low capitalization owing to the process by which such land has come into the possession of its present owners, the profit on the actual capital involved may be very high in good seasons. Whether profit from holdings of this nature should be considered on the actual outlay or on the capital which the business represents on the market at the present day is a subject which need not be discussed here.

Farming of all types is very subject to violent fluctuations in cash turnover. These fluctuations may be caused by seasonal variation affecting the volume of production, but the most serious cause is price-variations from season to season. Dairy-farming is perhaps the most stabilized branch of our primary industries, and the position there can be studied with comparatively reliable results on one season's returns. The individual farm units are small, and the fluctuations in total receipts have not been great for some years past.

In sheep-farming or mixed farming, where sales are of a more diversified type, price-variations may affect one or all of the products. It is therefore impossible to judge sheep-farming profits on one season only. To illustrate this point the gross yearly earnings of different commodities on the twenty-four farms here reviewed are shown separately for each season in Table 9.

Table 9.—Seasonal Fluctuations of Gross Returns per 1,000 Sheep wintered (Average of Twenty-four Farms).

1	2	3	4	5	6	7	8
Season.	Total Sheep wintered.	Sheep.	Cattle.	Wool.	Sundry.	Total.	Fluctuation from Average.
		£	£	£	£	£	Per Cent.
1921–22 ..	151,269	260	58	172	11	501	−42·01
1922–23 ..	152,279	443	75	365	7	890	+ 3·01
1923–24 ..	151,596	365	92	631	7	1,095	+26·73
1924–25 ..	164,579	449	145	556	7	1,157	+33·91
1925–26 ..	164,674	279	52	341	7	677	−21·64
Average	..	357	84	415	8	864	..

Fortunately seasonal price-fluctuation in one commodity is not always reflected in the others, which tends towards levelling of total receipts. In the two bad seasons low prices for sheep and wool have combined to aggravate the position. It will be seen in col. 8 that variation from the average is of such a magnitude that the effect of bad seasons must be reflected in the better years, as interest charges and maintenance expenses naturally accumulate.

Although expenses are to some extent curtailed during bad seasons, the fluctuation in working and management costs cannot be synchronized with receipts. In Table 10 interest and profit surplus is shown for each year.

Table 10.—Seasonal Fluctuations of Capital Position for 1,000 Sheep wintered (Average of Twenty-four Farms.)

1	2	3	4	5	6	7
Season.	Gross Returns.	Working-expenses and Management.	Fluctuation of Working-expenses, &c.	Interest and Profit Surplus.	Column 5 capitalized at 7 per Cent.	Total Capital represented per Sheep wintered.
	£	£	Per Cent.	£	£	£ s. d.
1921–22 ..	501	328	−12·30	173	2,472	2 9 5¼
1922–23 ..	890	343	− 8·29	547	7,814	7 16 3½
1923–24 ..	1,095	397	+ 6·15	698	9,972	9 19 5¼
1924–25 ..	1,157	403	+ 7·75	754	10,771	10 15 5
1925–26 ..	677	399	+ 6·69	278	3,971	3 19 5

Although working-expenses show fluctuations, the range is not great on either side of the average. The effect of seasonal price-variations is shown clearly in col. 7, where the total capital on which 7 per cent. interest is earned is interpreted in terms of sheep. There are still two items to be deducted from this amount—the value of stock and plant, and land-tax—before the real value of land and improvements can be shown on the basis which interests the farmer. This is done in Table 11.

Table 11.—Seasonal Fluctuations of Capital Position per 1,000 Sheep and per Sheep wintered (Average of Twenty-four Farms).

1	2	3	4	5	6	7
Season.	Interest and Profit Surplus.	Land-tax.	Interest on Stock and Plant at 7 per Cent.	Net Interest and Profit.	Column 5 capitalized at 7 per Cent.	Earning Value of Land and Improvements per Sheep.
	£	£	£	£	£	£ s. d.
1921–22 ..	173	56·96	115·50	0·54	7	0 0 1¾
1922–23 ..	547	47·03	115·50	384·47	5,492	5 9 10
1923–24 ..	698	43·86	115·50	538·64	7,695	7 13 10¾
1924–25 ..	754	40·14	115·50	598·36	8,584	8 10 11½
1925–26 ..	278	41·42	115·50	121·08	1,729	1 14 7

When all the farmer's expenses are taken into consideration, seasonal price-variations so affect the position that in very bad years the whole of the interest on borrowed capital has to be met from reserve or by bank overdraft. It is quite clear that, taking the good years with the bad, it is not easy for him to make a reasonable average interest on a moderate capitalization; and when land has been bought at a high price sheep-farming of this nature may become a hazardous occupation financially.

The writer wishes to record his appreciation of the co-operation of those farmers who placed their accounts at his disposal for the purpose of this analysis.

PIG RECORDING.

FIRST REPORT ON WORK OF WAIKATO, MANAWATU, AND MID-CANTERBURY GROUPS, SEASON 1928–29.

Introduction.

THIS report is issued by the Pig Industry Research Committee of the Council of Scientific and Industrial Research, and has been prepared from data and conclusions furnished by the three directing officers of the recording groups—Mr. M. J. Scott, Canterbury Agricultural College; Professor W. Riddet, Massey Agricultural College; and Mr. C. M. Hume, then of the New Zealand Co-operative Herd Testing Association, Hamilton.

The renewed interest in the pig industry of New Zealand apparent during the years immediately preceding 1928 gave possibilities of considerable expansion being made in this branch of production, and the need for information which might assist to guide this expansion into right channels led the Department of Scientific and Industrial Research to inaugurate, during 1928, pig-recording investigations in various districts of the Dominion.

Canterbury Agricultural College, Lincoln, had for some time previously been engaged upon experiments connected with the feeding and management of pigs, and had pioneered the way in pig-industry research. The results of some of this research had been published already in bulletin form ("Pig Production and Results of Feeding Trials," M. J. Scott, B.A., B.Sc., A.I.C., Bulletin No. 2, Department of Scientific and Industrial Research), and these results indicated that further investigatory work dealing with the pig industry was warranted.

During 1928 the Government signified its intention of helping the industry by providing a subsidy on the export of pork, and its interest in the pig-recording investigations was shown by a grant of £1,050 for their promotion. With this grant the Department of Scientific and Industrial Research was enabled to establish three pig-recording groups in the Mid-Canterbury, Manawatu, and Waikato districts. These districts were selected on account of their being typical of different feed conditions prevailing throughout the pig-raising districts of the Dominion. Trials with various pig-feeds were also inaugurated, special attention being given to the use of meat-meal and whey paste.

In the Waikato district skim-milk predominates as the pig-feed. In the Manawatu district the balance between skim-milk and whey is fairly even. In Mid-Canterbury skim milk is available generally in somewhat small supply, while quantities of cereal and grain feeds are available in generous amounts. In the Waikato and Manawatu districts, especially the former, there is a dearth of concentrated feeds, and such as are used require to be imported from the South Island and the maize-growing areas of the Poverty Bay and Bay of Plenty districts.

In view of the potentialities of greater utilization of the excellent pastures in the dairy districts, more attention should be devoted to the

possibilities of securing from them a better-balanced diet, which, used with the supplies of dairy by-products, would in some measure make compensation for the present dearth of cereals.

Economic factors in all districts necessitate the feeding of pigs on ill-balanced rations, whatever feed is available in greatest amount being fed to excess in all cases. Furthermore, both in the Waikato and in the Manawatu areas, the disposal of these surplus dairy by-products—whey and skim-milk—presents a problem on every farm. If discharged into drains or streams the consequent pollution quickly reacts on the farmers themselves. The only practical means, therefore, of disposing of these products is by pigs, and this very often in the not too sanguine hope that these will bring in some return. Statistics show that the pig industry in New Zealand is more closely associated with the dairying industry than with any other, and this association is very largely accounted for by the reason just mentioned.

During the last ten years methods of improving live-stock production have received considerable attention, with the result that "selection on performance" has come to be recognized as the surest way of making improvement. Whereas in the past selection for breeding purposes has been based on pedigree only, it is now clearly realized that unless purebred stock are also stock of high productivity their pedigree can be of little use. Breed associations should decline registration to animals which characteristically produce small litters. Performance has to be tacked on to pedigree, and the only way of evaluating performance is by keeping records of growth-rate and of production-costs. By doing so all the poor performers can be eliminated, and ultimately only the proven high producers will be used. To this end various systems of pig recording have been instituted in Denmark, Sweden, Norway, England, and Canada, and, while there are differences in the details from country to country, they all agree in collecting data concerning (1) number of piglets farrowed per litter, (2) litter weights and numbers per litter at four and eight weeks old, (3) details of feeding where possible, (4) details of housing, management, and care, (5) breed of sow and of boar.

To this end a recording officer goes round the locality and enrols those farmers who are willing to co-operate. Once contact is established the farmer keeps the recording officer informed by telephone or letter of dates of farrowing of sows. At the officer's convenience these pigs are earmarked and weighed at somewhere between three and five weeks old, and again between seven and nine weeks. From these weights those at four weeks and at eight weeks can be deduced. As a result of weekly weighings of about fifty litters at Lincoln College during eighteen months, it was found that little or no error is introduced by adjusting the weight in this way.

The three recording officers appointed in 1928 worked under the ægis of Canterbury Agricultural College, Massey Agricultural College, and the Waikato Group Herd Testing Association. They were supplied with means for weighing pigs, with travelling-allowances, and with standardized recording forms on which data relating to each farm and each pig were entered.

In addition to weighing litters, the pig-recording officers collected what information was available regarding breeding, feeding, systems of management, and mortality, and weighed as many fattening pigs as possible in order to get information on the normal rate of growth under varying conditions of management. It was not possible to follow the weights of all individual pigs till time of disposal, as farmers availed themselves of any opportunities of sale that arose, and accordingly in only a few cases were the final weights recorded.

The data so collected were partly worked up by the recording officers and partly by Mr. Scott, Professor Riddet, and Mr. Hume. Quarterly reports of the data were circulated between these three gentlemen, and thereby each was enabled to follow the results being secured in districts other than his own, and to set out a standardized scheme whereby comparisons between districts were possible.

At the outset of the work the recording officers visited those farmers who indicated their willingness to join in the scheme, an endeavour being made to secure, within as near a radius as possible, a total of between two and three hundred sows for recording purposes.

In the Manawatu district the local Pig-breeders' Federation showed much interest in the movement and used their endeavours to induce farmers to participate in the work. In other districts the interest displayed by pig-breeders was laudable, but during the course of the season a good many who at the beginning had indicated their readiness to participate in the scheme found themselves unable to do so. Pressure of work on the farm at the time of the recording officer's visit was often responsible for a farmer dropping out. The recording officer was almost entirely dependent upon the active assistance of the farmer himself in order to conduct the weighing expeditiously. At such seasons as haymaking time this assistance was not forthcoming. Again, in some instances farmers were so disappointed with the litters of young pigs farrowed that they were reluctant to have these figures recorded. The sale of young pigs as weaners was also responsible for a number of breaks in the records.

On many farms the facilities for yarding and weighing the pigs were poor. Recording of pigs is by its very nature somewhat difficult and arduous work, and during wet weather the actual labour of weighing became a task which most were reluctant to undertake. For these reasons there was some defection of farmers as the season progressed, a trouble which was common to all the districts.

Table 1.—Summary of Completed Records.

District.	Number of Farms.	Number of Sows recorded.	Number of Feeding Trials conducted.
Waikato	37	245	About 40
Manawatu	37	121	..
Mid-Canterbury	37	126	20

Table 2 summarizes the data secured in regard to litter-size and litter-weight at various ages in the three districts.

Table 2.—Litter Numbers and Weights at Various Ages.

District.	Pigs born per Litter.	Litter-weight at Four Weeks.	Pigs per Litter at Four Weeks.	Weight per Piglet at Four Weeks.	Litter-weight at Eight Weeks.	Pigs per Litter at Eight Weeks.	Weight per Piglet at Eight Weeks.
		lb.		lb.	lb.		lb.
Waikato ..	..	97·7	7·40	13·2	207	7·4	28
Manawatu ..	9·1	106·5	7·3	14·7	229	7·3	31·5
Mid-Canterbury	10·1	109·0	8·00	13·6	230	7·95	29

Points from Tabulated Data.

MORTALITY.

Columns 1 and 3 of Table 2 show that there is a 20-per-cent. mortality occurring from birth to weaning date. Most of the deaths occurred within two to three days of birth, and where deaths are low they could be prevented by more care on the part of the owner. There is considerable ground for the belief that mortality is due to faulty feeding and management prior to birth, and that this point is worthy of closer consideration from a nutritional aspect. Proper feeding and care of the sow prior to farrowing and due attention to sanitation are powerful influences tending to reduce the mortality which occurs among very young pigs.

BREED INFLUENCES.

By the average farmer the influence of breed upon mortality-rate and litter-weight is given greater importance than is accorded to individuality. Tables 3 and 4 set out the relation of the breed to litter-weight at eight weeks. The averages would appear to indicate advantages in favour of the two bacon breeds, Large Black and Large White, but the smaller numbers of these recorded give less significance

Table 3.—Litter-weights at Eight Weeks from Various Breeds of Sows.

District.	Berkshire.	Tamworth.	Devon.	Large White.	Middle White.	Tamworth-Berkshire Cross.
	lb.	lb.	lb.	lb.	lb.	lb.
Waikato	213·8	216·3	..	299·9	141·8	198
Manawatu	213	219	277	263	231	217
Mid-Canterbury ..	225	..	300	..	..	220

Table 4.—Litter-weights at Eight Weeks from Various Breeds of Boars.

District.	Berkshire.	Tamworth.	Devon.	Large White.	Middle White.
	lb.	lb.	lb.	lb.	lb.
Waikato	188	205·9	..	381·2	154·8
Manawatu	217	225	290	244	232
Mid-Canterbury ..	225	..	292	273	180

to the data than those of the Berkshire and Tamworth breeds, and this obscures the position considerably. It is important to appreciate that all breeds can produce good litter-weights at eight weeks old, just as in the case of dairy cows, but more influence should be attached to factors other than breed.

The comparison of all breeds together is open to the objection that this ignores the type of pig. Breeders have in the past aimed at producing pork types as opposed to bacon types, the former being plumper than the latter and accordingly more prime for slaughter as pork from 90 lb. to 130 lb. live-weight. Thus it may be stated that the larger frame of the bacon breeds is more conducive to heavy litter-weights at eight weeks. There is some evidence that such a contention is not fully justified in that bacon types can also suit the porker trade. Further experience on this point is required. Meantime it can be said that other factors appear to be more important than breed, and in a general survey of breeds the Large White and Large Black have possibly some advantages.

SIZE OF LITTER.

It is evident from Table 6 that the size of the litter does not materially affect the individual weight of piglets at eight weeks (column 4). This, then, is a point in favour of sows having large litters. The size of the

Table 5.—Size of Litter in Relation to Litter-weight and Average Weight per Piglet

Number of Pigs per Litter.	Number of Litters.			Average Litter-weight.			Average Weight per Piglet.		
	Canterbury.	Waikato.	Manawatu.	Canterbury.	Waikato.	Manawatu.	Canterbury.	Waikato.	Manawatu.
				lb.	lb.	lb.	lb.	lb.	lb.
3 ..	..	..	2	..	..	102	..	..	34
4 ..	..	..	8	..	..	162	..	..	40·4
5 ..	5	25	14	185	137	164	37	27·4	32·7
6 ..	14	30	25	188	171	200	31·2	28·5	33·3
7 ..	19	43	23	203	197	228	29	28·2	32·5
8 ..	21	44	21	247	221	226	30·9	27·7	33·2
9 ..	18	27	13	258	232	283	29·4	25·8	31·4
10 ..	11	22	8	295	261	299	29·5	26·1	29·8
11 ..	5	2	6	346	367	281	31·5	33·3	25·5
12 ..	..	2	1	..	418	257	..	34·8	21·4

Table 6.—Average of all Records: Litters grouped by the "Number per Litter."

Number of Pigs per Litter.	Number of Litters.	Average Litter-weight.	Average Weight per Piglet.
		lb.	lb.
5	44	151	30·2
6	69	185	30·8
7	85	206	29·5
8	86	238	29·8
9	58	252	28·0
10	41	276	27·6
11	13	319	29·0
12	3	361	30·0

litter does very materially affect the litter-weight, as is seen from column 3. Farmers aiming at prolificacy need fear no loss in weight of piglets, provided they give attention to individuality, feeding, care, and management. The differences in the average weights per piglet appearing in column 4 are not significant, but the table shows that larger litters are not secured by sacrificing the weights of the individual piglets of which they are composed.

LITTER-WEIGHT AT EIGHT WEEKS.

Litter-weight at eight weeks of age appears to be the crux of consideration. It is related to numbers in the litter, but not alone to the question of number. There can be heavy litters at eight weeks with litters of average size, just as there can be with litters of larger size. Feeding, management, and breeding no doubt all play a part. It is undoubtedly an aim well worthy of attainment to secure good litter-weight at eight weeks, and, while the present average is 225 lb., it is possible to obtain more than double this weight.

It will be seen from Table 8, column 5, that the weight per piglet increases progressively, so that the piglets in the heaviest litters are twice as heavy as those in the lighter litters. The produce of the sow is the thing that counts, and it is by increasing the weight per piglet that these can be most improved, as heavy piglets indicate good feeding, housing, and management, while the lighter ones indicate the reverse. Indeed, litter-weights provide a good index of the quality of management. The number of pigs born cannot be subsequently increased, and although this number is largely influenced by the treatment received by the sow prior to farrowing it is not entirely controlled by man, and lies largely in the power of the animal. Until the management factor is standardized the influence of heredity cannot be definitely measured. The part played by the owner in the care of the sow is of the greatest importance, and reference to Table 8 shows that the heaviest litters are about four times as good as the lightest.

It has been found as a result of the past year's work that, whatever the conditions obtaining on the farm, the litter-weight at sixteen weeks old can be forecast from the litter-weight at eight weeks old, because in general the feeding remains the same throughout in the cases reviewed.

The distribution of litter-weights at eight weeks in the three groups brings into prominence the large proportion of sows which produce litters whose eight-weeks weight is less than 200 lb., while only some 15 per cent. of all litters reach weights of 300 lb. or over at this age. This large percentage of low-weight litters is a serious economic handicap to the industry, and emphasizes the need for paying due attention to weaning weights and the factors upon which they are dependent—namely, breeding, feeding, and management.

Table 9 gives actual data on the relation of litter-weights. In general if the weight at eight weeks is multiplied by $2\frac{1}{2}$ the result will be very close to the weight at sixteen weeks. Piglets weighing 20 lb. at eight weeks weigh 50 lb. at sixteen weeks, and will require feeding for another six weeks to reach pork weights. Piglets weighing 40 lb. at eight weeks weigh from 90 lb. to 100 lb. at sixteen weeks—the

Table 7.—Litter-weights at Eight Weeks old, arranged by Class Intervals of 50 lb.

Class Average.	Number of Litters.			Average Weight of Litters.			Number of Pigs per Litter.			Average Weight per Piglet.			Average Deaths per Litter.
	Waikato.	Canterbury.	Manawatu.	Waikato.	Canterbury.	Manawatu.	Waikato.	Canterbury.	Manawatu.	Waikato.	Canterbury.	Manawatu.	Manawatu.
lb.				lb.	lb.	lb.				lb.	lb.	lb.	
Up to 100 ..	..	..	1	..	..	67	..	..	3·0	..	..	22·2	8·0
101–150 ..	45	10	12	128	140	127	6·5	6·8	5·5	19·7	20·8	23·1	3·2
151–200 ..	54	24	36	175	180	178	7·0	7·1	6·0	25	25·3	29·7	2·3
201–250 ..	55	26	31	234	224	224	7·8	7·7	7·9	28·7	29·1	28·1	1·4
251–300 ..	24	14	20	276	278	271	8·7	8·5	8·0	32	32·6	34·0	1·5
301–350 ..	7	11	12	331	324	318	8·4	9·1	9·3	39·3	35·7	34·6	1·3
351–400 ..	4	3	6	374	367	369	9·0	9·3	8·5	41·6	39·4	43·4	1·3
401–450 ..	3	5	1	437	429	412	9·7	10·0	9·0	45·2	42·9	45·8	1·0
451–500 ..	1	..	1	481	..	460	11·0	..	9·0	43·7	..	51·1	..
501–550 ..	1	..	1	541	..	524	12·0	..	8·0	45·1	..	65·5	..

Table 8.—Average of all Records: Litters arranged by Weights; those of similar Weights in one Group. Class Intervals of 50 lb.

Class.	Number of Litters.	Number of Pigs per Litter.	Average Weight per Litter.	Average Weight per Piglet.
lb.			lb.	lb.
101–150	67	6·4	129	20·2
151–200	114	6·7	176	26·3
201–250	112	7·8	223	28·8
251–300	58	8·4	274	32·6
301–350	30	9·0	323	35·9
351–400	13	9·1	369	41·0
401–450	9	9·8	429	43·9
451–500	2	10·0	..	47·0
501–550	2	10·0	..	53·2

system of feeding being almost constant throughout—and are then ready for killing (the best reach pork weights at fourteen weeks old). Conditions that produce heavy litters save nearly half the feeding-costs, or, looked at from another point of view, they increase considerably the returns from the feed available.

Table 9.—Relation of Litter-weights at Eight Weeks old to those at Sixteen Weeks old.

Records.	Litters weighing less than 250 lb. at Eight Weeks.	Litters weighing more than 250 lb. at Eight Weeks.
Canterbury	257 per cent. (13 litters)	251 per cent. (16 litters)
Waikato	242 per cent. (53 litters)	241 per cent. (18 litters)

It has been found that some sows produce less than 150 lb. weight of pigs at eight weeks, while others of the same breed produce up to 400 lb. weight. This difference is, of course, not entirely attributable to the sow. The importance of getting piglets up to good weight at weaning-time—eight weeks—could not have been realized, but it has now been proved from the result of the past year's work that getting piglets up to heavy weights at eight weeks old is the key to the whole question of economic production. The relationship between litter-weight at eight and sixteen weeks old respectively forcibly demonstrates the all-important part played by management, feed, and care. These factors mask completely the animal factors of prolificacy and thrift, which alone have been too much looked to in order to bring about an improvement in production.

FEEDING.

That rational balanced feeding plays an important part is shown by Table 10.

Nursing-sows fed on ill-balanced feeds such as whey and skim-milk, from which they have to abstract all their solid nourishment after the ingestion of large volumes of liquid, give disappointing results. It was possible only in a few cases to collect sound information relating to feeding, but it appears clear that those who use various meals with dairy by-products discreetly, and who get satisfactory results,

Table 10.—Litter-weights at Eight Weeks classified by Food given to Sows while nursing. (Manawatu Records.)

Feed.	Number of Litters.	Average Number per Litter reared.	Average Weight per Litter.	Average Weight per Piglet.	Average Deaths per Litter.
			lb.	lb.	
Whey only	6	5·8	136·6	23·4	4·1
Whey and meal* ..	32	8·2	258·9	31·2	2·1
Skim-milk only ..	7	7·6	187·7	25·8	2·3
Skim-milk and meal* ..	42	6·6	226·4	33·8	1·3†
Buttermilk and meal* ..	25	6·9	223·7	32·5	1·8

* No record kept of particular meals used.
† First litters from young sows only participated in this trial.

do so at a profit. In the figures collected in the Waikato the best return amounted to £5 18s. per cow from pigs after paying for concentrates, the basic diet being skim-milk. Even the average of about £3 10s. secured on other good farms indicates the beneficial results to be derived from paying attention to details. In Canterbury, where grain was freely used, the best breeders realized a return of £4 16s. per cow, an amount rendered possible largely by the copious supplies of cheap grain. It is unfortunate that our national supplies of skim-milk and whey on the one hand and cereals on the other are so widely separated by distance. The great bulk of New Zealand pig-feed consists of dairy by-products. In other countries 6 lb. of milk is held to have the same feeding-value as 1 lb. of grain. Since in New Zealand grain has generally to be bought for dairy-farms its value as opposed to its cost does not enter the question, and it can be purchased only when its use renders a higher net return possible for skim-milk or whey. The results secured where whey was used as a basic diet did not, of course, approach those where skim-milk was used. Nevertheless, while the results from whey seem to be at least one-half as good as those from skim-milk, it is significant that whey could be satisfactorily and profitably fed by some breeders.

MANAGEMENT.

Tables 11 and 12 indicate the importance of management. Good pigs, careful feeding, and attentive management all play a part in returning a profit. Undue attention to any one feature has serious limitations, and the results emphasize more than ever the fallacy of the idea that the pig is only a convenient means for disposing of skim-milk and whey.

WINTER FEEDING.

An outstanding feed factor which limits economic production in every district in New Zealand is the incomplete nature of winter feed, with the resultant loss of thrift, high mortality, and long recovery period when milk comes in. Almost 50 per cent. of sows are barren for half the year because dairy by-products are unavailable and the price of other fattening-foods is not sufficiently attractive. This represents an enormous potential loss to the industry. This condition of affairs is due to some extent to the absence in the past of any cheap supply of flesh-forming feed to make up the deficiency in milk by-products. As a result of local research in pig-feeding there are now available in almost every district in New Zealand plentiful supplies of meat-meals from freezing-works at prices of about £13 a ton. With any class of winter feed (grass, roots, potatoes, artichokes, marrows, &c.) the use of ½ lb. of meat-meal per pig per day will give entirely new values to the feeds used. Where meat-meal has been used in trials during the last three years it has increased the return from these winter feeds by as much as ten times.

DISTRIBUTION OF PUREBRED PIGS.

Farmers who realized that such wide variations occurred in their litter-weights were keen to improve their stock of pigs. Accordingly some who owned crossbred and mongrel types, and who considered that pig-raising held some promise of profitable returns, took steps to

Table 11.—Data from Waikato Skim-milk Farms (showing Return per Cow from Pigs in Column 13).

(1.) Farm Reference No.	(2.) Acreage.	(3.) Number of Cows.	(4.) Butterfat produced.	(5.) Number of Calves reared.	(6.) Number of Cows to supply Milk for Calves.	(7.) Cows supplying Pigs.	(8.) Number of Sows.	(9.) Farrowing-dates.	(10.) Store Pigs wintered.	(11.) Gross Return from Pigs.	(12.) Cost of Concentrates.	(13.) Net Return from Pigs.	(14.) General Conditions.
			lb.							£ s. d.	£ s. d.	£ s. d.	
220	75	30	5,000	15	8	22	7	Aug. to Feb.	42	135 0 0	7 10 0	5 18 0	Good houses and sties in good repair. All weaners run together till put into sties to fatten.
135	200	55	12,000	18	9	46	10	July to Nov.	18	225 0 0	7 0 0	4 15 0	Each sow separate pen, ¼ acre. After weaning all run together. No sties. Pigs fattened in small paddock.
75	42	20	4,400	6	3	17	6	Sept. to Oct.	..	67 0 0	0 8 0	3 15 0	Two sows together on 1 acre. Sells weaners and stores.
214	200	52	14,500	10	5	47	8	Sept. to Feb.	..	155 0 0	4 2 0	3 4 6	Housing fair. Sows farrow outside. All piglets run together. Maize-meal.
227	150	36	12,200	9	5	31	4	Aug. to Mar.	23	156 12 0	74 8 0	2 13 0	Good sties. Farrow outside. Good grass always. Pollard and pig-meal.
215	113	45	14,130	10	5	40	7	June to Dec.	7	179 0 0	56 0 0	3 1 6	Sows farrow outside. Well wintered. Good grass always. Barley-meal.
194	80	28	8,120	3	2	26	5	Aug. to Feb.	18	60 0 0	..	2 10 8	Conditions bad. All pigs run together; sold as stores and weaners.
109	30	13	3,260	7	4	9	2	Aug. to Mar.	..	25 8 0	2 8 0	2 12 5	Good houses in bad repair. Pigs all run in one paddock.
84	50	28	7,000	5	3	25	4	July to Nov.	9	57 0 0	..	2 5 7	Sows farrow in small runs. Piglets in paddock till put in sty to fatten.
43	36	18	4,500	10	5	13	5	July to Sept.	..	30 0 0	6 8 0	1 16 0	Small pens; bad conditions; bad drainage; wet sties.

Table 12.—Data from Whey Farms (showing Return per Cow from Pigs in Column 13).

(1.) Farm Reference No.	(2.) Acreage.	(3.) Number of Cows.	(4.) Butterfat produced.	(5.) Number of Calves reared.	(6.) Number of Cows to supply Milk for Calves.	(7.) Cows supplying Pigs.	(8.) Number of Sows.	(9.) Farrowing-dates.	(10.) Store Pigs wintered.	(11.) Gross Return from Pigs.	(12.) Cost of Concentrates.	(13.) Net Return per Cow from Pigs.	(14.) General Conditions.
			lb.							£	£	£ s. d.	
162	106	50	15,720	7	4	46	6	May to Aug. Nov. to Feb.	..	140	26	2 12 0	Sows in 4-acre paddock; good shelter. Pigs weaned on same paddock till drafted to sties to fatten. Pollard.
141	208	90	23,078	10	5	85	8	Sept., Dec. to Mar.	81	216	27	2 3 0	Run of the farm. This year litters carried through, and fatten next year; abundant grass. Sows poor. Pollard.
76	100	35	11,030	8	4	31	5	July to Sept.	23	70	8	2 0 0	Sows farrow in one paddock; housing bad. Pigs have run of farm. Good shelter. Casein, whey, pollard, and linseed.
180	149	70	18,000	21	12	58	10	May to Oct.	28	120	12	1 15 2	Small pen for each sow; not pig proof. Houses fair. Pigs run together. Plenty of grass. Fair shelter in paddock.
135	97	52	14,800	6	3	49	5	July to Dec.	10	93	7	1 15 0	Sows run together. Pigs after weaning have run on gully. Good sties, used only for fattening. Pollard and pigmeal.
232	140	50	11,750	16	8	42	8	July to Feb.	..	95	31	1 10 7	Skim-milk and whey. Good pens and sties. Pigs neglected for first six months. Green oats supplied in spring. Good pollard available.

purchase purebred sows and boars. In their purchases they were assisted by the pig-recording officer, and this aspect of his work should, with discreet handling, be productive of distinct improvements in the general quality of pigs kept.

Summary and Conclusions.

(1) Three recording groups—in the Waikato, Manawatu, and Mid-Canterbury districts respectively—made regular weighings throughout the 1928–29 season of the litters of some five hundred sows.

(2) Records of the number of piglets and their weights were made at farrowing, at four weeks and eight weeks of age. In some cases records of management and feeding were also made.

(3) The average of all litters weighed was 225 lb. at eight weeks old. Litters of five piglets gave the lowest average weight—140 lb.—while those of twelve piglets gave the highest average—418 lb. 72 per cent. of all litters weighed did not exceed 250 lb. at eight weeks.

(4) Heavy litters comprised of piglets of 40 lb. weight at weaning pay better than light ones—that is, piglets of 20 lb. It has been found that whatever the piglets' weight at eight weeks it is two and a half times as great at sixteen weeks (40 lb. weaners weigh 100 lb., and 20 lb. weaners 50 lb., at sixteen weeks), the assumption being that feeding and management during the period remain consistent and show no marked variations.

(5) The management of the sow and the litter was found to be a most important factor in the production of pig meat per sow per annum.

(6) The records made so far give no reliable information regarding strain and breed influences. The predominant influences are those concerned with feeding and management. Strain and breed influences can be assessed only after several years of continuous recording.

(7) The numerical size of the litter makes no significant difference in the weights of the individual piglets.

(8) Litter-weights are a good index of the quality of pig-management.

(9) Pigs under proper conditions are capable of producing a return of up to £5 per cow where skim-milk is used as a basic diet, and about one-half this sum where whey replaces skim-milk.

(10) This return is obtained by having clean and dry housing conditions, feeding a little grain judiciously (about 6 per cent. of the total turnover), looking after sows before farrowing, giving due consideration to correct farrowing-dates, buying no store pigs, and selling only fat stock, mostly as pork. These things are the essence of profitable production. Large quantities of grain used in a haphazard manner do not provide the solution of the problem until the points detailed are attended to.

(11) Skim-milk and whey in themselves form good basic diets for pigs, but are very greatly improved by the addition of concentrates in the form of grain or meat-meals.

(12) The use of $\frac{1}{2}$ lb. of meat-meal per day for sows and stores in winter would make it profitable to have two litters per year, and to carry stores through the winter on present feeds in a thriving condition that would avoid present losses and give a quick return for the early milk.

PARTURITION IN BOVINES.

SOME MALPRESENTATIONS AND HOW TO DEAL WITH THEM.

J. LYONS, Director of the Live-stock Division, Wellington.

A NUMBER of requests have been received of late that the subject of the calving of dairy cows should be dealt with afresh in the *Journal*. The present article has been written not with the idea of making all readers who are interested in the subject expert obstetricians, but rather in the hope that it may emphasize the danger of undue interference by those not qualified to undertake such work, and that it will lessen the suffering and save the lives of many members of our herds.

While any article written on parturition may be of considerable service, more especially to the trained worker, it will not in itself be sufficient to qualify the farmer as an operator. Each case presents its own difficulties, and it is only by clinical experience that such difficulties can be met and overcome, and only the few are fitted for the work. To the trained obstetrician few cases present difficulties which cannot be overcome and the fœtus delivered safely, provided that there has not been undue prior interference and that he is given the case within a reasonable time.

At this stage I would like to give a word of warning to those in attendance on such cases. The practice of laying hold of any part of the fœtus presented—usually a leg—and applying traction cannot be too strongly condemned, and it has caused the death of many valuable animals. Should the presentation be an abnormal one the calf becomes tightly jammed in the pelvic region, thus rendering delivery more difficult, and the more difficult the delivery the greater will be the source of danger to the dam. Again, even in normal presentations, where the passage is somewhat narrow and constricted, as seen in first-calving heifers, the practice of using traction when only the legs are in evidence may cause the head to be turned round, thus rendering what would otherwise have been a simple case a most difficult one. This must of necessity be so, owing to the fact that the calf is jammed into the pelvic cavity and must be dislodged therefrom, either by incision or by manipulation, before delivery can take place. The operation is also rendered more difficult by the escape of the natural fluids from the womb, for when this takes place the organ contracts on the fœtus, making any attempt at delivery still more difficult.

In all cases of delayed parturition, before pressure is applied, the attendant should insert the hand and arm and satisfy himself that the calf is in the right position. In the event of any malpresentation it should be rectified first.

The following rules should be strictly observed by those in attendance on cows experiencing difficult parturition :—

(1) The hands and arms must be thoroughly washed in an antiseptic solution. The finger-nails should be cleaned with a scrubbing-brush, so that any offensive matter adhering to them may be removed.

(2) All instruments, cords, &c., should be thoroughly sterilized before use.

(3) When the hand and arm are inserted for the purpose of finding the position of the fœtus in the womb, the operator should make up his mind as to what requires to be done and rectify any fault if possible without withdrawing the hand. The friction caused by too frequent insertion of the hand sets up inflammation.

(4) A cow should not be calved in or near dirty or unsanitary surroundings.

(5) Undue force should not be used.

(6) The animal should be fed sparingly for a few days after delivery.

(7) Secure with cords any portion of the fœtus that may be presented, so that if that portion must of necessity be pushed back it can easily be recovered again.

In normal presentations the two forelegs are presented with the head lying directly above them, the eyes being level with the knees. In this presentation the animal does not require assistance, except in cases where the calf is dead or with heifers at the first calving. Even then undue pressure should not be applied, and care should be taken to ensure that the head is coming forward with the legs.

It should be remembered, as already stated, that in a case where the calf is dead and where the membranes containing it have ruptured and allowed the fluids to escape, the womb contracts on the fœtus and renders any necessary adjustments of the limbs, head, &c., far more difficult. The same applies when an inexperienced attendant, in trying to effect delivery, ruptures the membranes and is unable to complete the work. For this reason delivery should not be undertaken by the inexperienced.

Malpresentations.

Two front Legs presented, with the Head turned back.

In this case the hand should be inserted, and by pushing the calf back the head may be manipulated into position and delivery effected by traction, keeping the head in position with the hand so that it may not return to its former position. The hand can be withdrawn when the head is well into the passage. In other circumstances it may be necessary, in order to secure the head, to place a hook in the eye-socket or the angle of the jaw in order to manipulate it forward, or a strong cord may be used attached to the lower jaw just behind the teeth.

In presentations of this kind it is sometimes found that the head has dropped between the forelegs and one leg is over the neck of the calf. If this is the case it is waste of time trying to recover the head from such a position without first removing the leg. In order to do this it is necessary to skin the leg. A knife, preferably with a hooked point, should be introduced until the calf's shoulder is reached; it should then be inserted and a straight cut made through the skin until the fetlock is reached, when a circular incision should be made round the limb and the skin separated from the bone. When enough skin has been removed to form an attachment it should be secured with a strong cord so as to hold it in position, and the remainder of the leg should be skinned with the fingers until the elbow joint is reached. A knife should then be introduced with the hand, and the muscles between the shoulder-blade and the ribs severed; meanwhile traction should be applied to the legs to facilitate severing the muscles, and

FIG. 1. NORMAL PRESENTATION: NOSE BETWEEN KNEES AND FORE FEET FOREMOST.

[After H. Thompson.

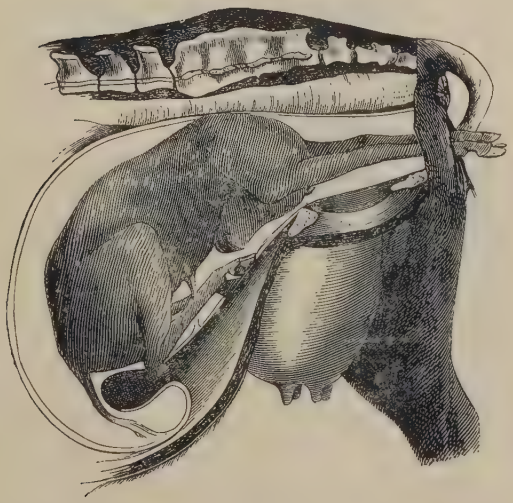

FIG. 2. FORE LEGS PRESENTED, WITH HEAD TURNED BACK.

[After G. Fleming.

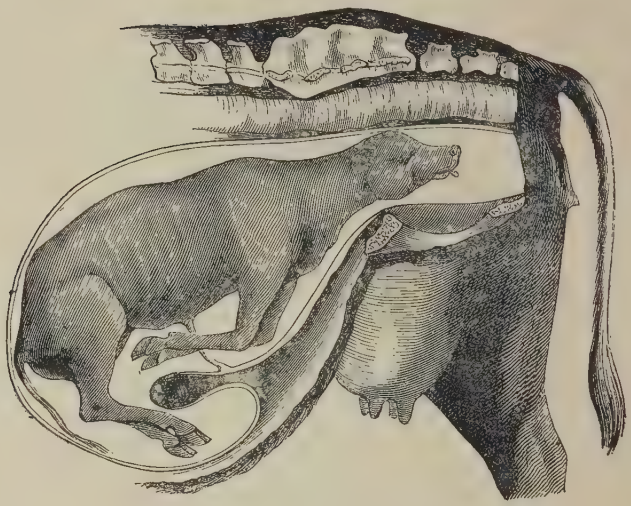

FIG. 3. HEAD PRESENTED, WITH FORE LEGS TURNED BACK.

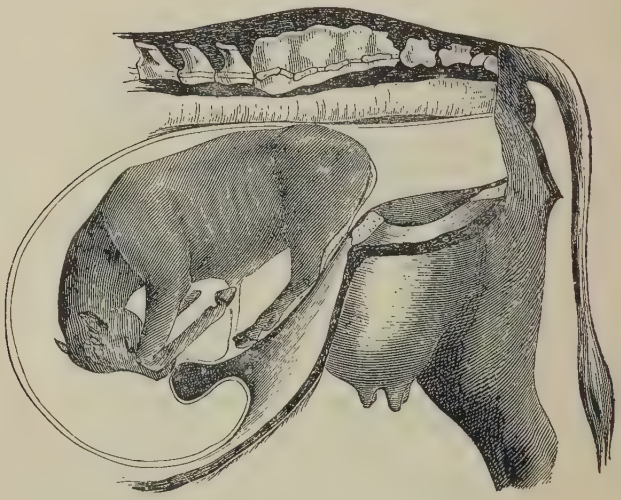

FIG. 4. BREECH PRESENTATION: HINDQUARTERS PRESENTED, WITH LEGS UNDERNEATH BODY.

[After G. Fleming.

the leg will then come away easily. It may then be found that the head can be adjusted, but if not it will be necessary to remove the other leg in like manner. When the body is deprived of its support it drops into the cavity of the womb, allowing the head to be brought round by means of hooks or cords; after which, by applying traction, delivery can be effected.

One or both Forelegs turned back, with Head presented.

In some presentations of this kind, more especially if the head is still in the passage, it will be found that by pressing the head back the limbs can be brought forward and delivery effected. In the majority of cases, however, before delivery can be brought about it is necessary to remove the head. In doing so the head should not be directly severed from the body, for if this is done the bones of the neck are left exposed, and, as the neck must be pushed back in order to recover the legs, in bringing the fœtus forward again the exposed bones are liable to injure the passage of the dam.

To remove the head the skin should be cut all round just above the eyes, and the remainder of the head skinned until the first joint of the neck is reached, where it can be severed and the skin tied securely over the bones and secured by a stout cord. This not only forms a protection but also affords a means of traction when required later. As indicated, the neck should then be pushed back and the legs brought forward, when the fœtus can readily be brought away.

In such cases considerable difficulty will be experienced by those not accustomed to the procedure in bringing the limbs forward. In endeavouring to do this the limb should be bent at the knee and the knee itself lifted over the brim of the pelvis, when, by pressing the bent knee towards the spinal column, it will be found that the remainder of the limb can be brought forward.

Breech presentation: Hind-quarters only presented, with legs underneath Body.

In a case of this kind it may sometimes be possible with a big roomy cow to extract the calf as presented. In the majority of cases, however, it will be necessary to manipulate the legs so as to bring them forward and deliver in the ordinary manner for a breech presentation. To accomplish this it will be necessary to push the fœtus well into the womb by means of a crutch, and then to work the leg upwards until the foot is grasped. Bend the toe into the hollow of the heel, at the same time keeping the hock bent, then lift the hock over the pelvis, and by still keeping the hock bent and pressed towards the spinal column the remainder of the leg can be brought forward. In like manner the other leg can be brought into position, when delivery can be effected.

Practice in cases of contraction: In all cases in which the cow has been in labour for a considerable period and the fluids from the womb have escaped and contraction taken place, so that the womb has tightly closed upon the fœtus, it is almost impossible to manipulate the limbs into position as described. Under such circumstances it will be necessary to sever the limbs from the body and remove them thigh

foremost. For this purpose a small wire cord with a loop at each end should be used, for which purpose piano-wire will answer admirably. One loop should be taken in with the hand and placed round the thigh and again brought to the outside, when a small handle can be placed in each loop, and by pulling the wire backwards and forwards the limb can be severed from the body in a few minutes. While this operation is going on care will need to be exercised to prevent friction by the wire coming in contact with the passage. A hand placed between the wire and the membranes of the vagina gives the necessary protection. When the legs have been removed the remainder of the fœtus is easily brought forward. To these parts hooks and cords may be attached and by these means extracted. If it is found that this cannot be accomplished the abdominal cavity should be opened and the organs extracted. It will be found that this lessens the resisting forces considerably, and assists in bringing about delivery.

(To be continued.)

WOOLLY FINGER-GRASS.

A DRY-LAND SPECIES WITH POSSIBILITIES.

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THE grass genus *Digitaria* is made up of some fifty species, mostly weedy annuals. Crab-grass (*D. sanguinalis*) is such a weed species, now plentiful in the warmer parts of New Zealand. On the veldt of South Africa occur a number of species, some of which are perennial and present more or less useful characters. One that has aroused considerable interest in South Africa is woolly finger-grass. As this plant has properties that suggest it may prove of value in areas such as Central Otago, it seems worthy of investigation. Incidentally it illustrates the need for extensive strain study, such as that being undertaken by Messrs. Levy and Davies with perennial rye-grass and other species in New Zealand. Only so can the more useful be separated from the less useful forms. A few notes on the experiments with this grass in South Africa may be of interest at this juncture. The information here given is derived from articles that appeared in *Farming in South Africa*. These were kindly sent me by Miss Sydney M. Stent, Agrostologist, Division of Plant Industry, Department of Agriculture of the Union of South Africa.

The grass first attracted special attention about seven years ago on the experiment farm situated in the Vryburg area, and was identified as *Digitaria eriantha* var. *stolonifera*. It was considered to have a wide distribution in South Africa. A survey, however, revealed that there were many different species, varieties, and strains of stoloniferous digitarias to be met with. While many of these showed close resemblances to the Vryburg grass they behaved differently under cultivation. Miss Stent is therefore making a study of the systematics of these forms, an essential preliminary to economic work. In what follows the Vryburg grass is referred to.

WOOLLY FINGER-GRASS.

[*From "Farming in South Africa."*

Woolly finger-grass is a tufted perennial, spreading by overground runners. As growing on the veldt the plant has blue-green, rather short leaves, usually softly hairy all over. As it spreads the grass forms a dense cover that smothers out weed-growth. The flowers are developed on about five finger-like spikes at the ends of long branches, but it appears to be an extremely shy seeder. It is essentially a dry-land grass, occurring, for example, on the sandy soil of the Kalahari. "Left to themselves," says Miss Stent and Mr. Pentz, "the farming community would probably never have evolved the idea of planting out pure pastures of woolly finger-grass and using it as a winter feed, for the simple reason that observations would merely have shown them that, like most of the veldt grasses, it became dry and frosted during the winter, and they had no means of knowing of the special properties and qualities in the composition of this grass that gives it such a comparatively high feeding-value in its dried and frosted winter state."

Dr. Henrici, plant physiologist, seeking the cause and nature of the deficiency in the veldt of Vryburg that produces phosphorus-craving in animals, worked out the chemical analyses of many of the grasses, and noted that woolly finger-grass possessed certain qualities lacking in the others. The grass wilts easily, probably because it has less fibrous tissue than the other veldt grasses. In spring, after heavy rains, it contains hydrocyanic acid during wilting, but later in the year there is no trace of this. It is much richer in protein and in carbo-hydrates, and lower in fibre, than the other grasses analysed. Thus it can provide more nourishment even in the brown and dry condition.

A grazing test on six one-acre plots of pure pastures of various grasses was prepared at the Dryland Experiment Station, a cow being placed on each acre. At the end of three years the cow and the woolly-finger-grass pasture were both in excellent condition, while the others had failed to support their animal for even one year. Further tests with cows and with sheep are in progress. The grass, it is recorded, proves extraordinarily resistant to heavy stocking and close grazing, while its close growth conserves the soil-moisture.

"It must be borne in mind," remarks Miss Stent, "that the experiments carried out with this grass and the preliminary results obtained were only under certain local Pretoria conditions, and only with one acre of the grass and with one particular strain. To thoroughly know and understand the grass and its requirements and possibilities it is necessary to carry out wider and more comprehensive experiments on a larger scale, under different conditions, and in other parts of the country."

A small shipment of the grass is being obtained by the Agrostologist, Department of Agriculture, for observation in New Zealand.

Goats and Forests.—"Goats constitute a menace to the Taranaki, Wellington, Nelson, and Canterbury forests," states the annual report of the State Forest Service for 1928–29, "and field officers have been instructed to carry rifles and energetically carry out goat-destruction. Experimental shipments of hides have been sent overseas, and it is hoped that favourable prices will be received. The browsing habits of these animals render them second only to deer as destroyers of forest regeneration, and additional sums are necessary to engage shooting parties and to issue free ammunition in certain badly infested areas."

DISEASES OF DAIRY COWS.

(Continued.)

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III. STERILITY.

WHEN one considers the great importance and economic significance of the subject of sterility in dairy cows, it is really surprising to find how comparatively little useful work has been accomplished, and also the marked disagreement in published works. The writer has therefore attempted to record some of the latest views on this all-important and difficult problem, and at the outset would wish to express his indebtedness to several of his veterinary colleagues on the Continent of Europe for many of the opinions here expressed, and for their personal views on the subject. He would name in particular Professor Folmer Nielsen, of Copenhagen, Professor Stalfors, of Stockholm, and Professor Goetze, of Hanover, authorities whose kindness and assistance have been of the greatest value. Professor Folmer Nielsen gave his valuable time, excellent equipment, and many years of practical experience for demonstrating his methods of diagnosis and treatment of cases of sterility.

In the first place it should be noted that "sterility" is to some extent a misleading term, since in the strict sense it means inability to reproduce, and this occurs in a relatively small number of cases only. The more correct designation would therefore be "diminished fertility"; or, again, it would suffice to define the term as "diminished faculty" of the female (at any rate at the given moment of service) to become pregnant and to preserve and continue this pregnancy, until the latter is either capable of being diagnosed by rectal palpation or until an interruption of the pregnancy sets in as an observable abortion (Nielsen).

It should also be remembered that infertility or sterility is not a definite disease, but rather a failure of a functional capacity which may arise from any deviation from the normal, such as malformations, diseases of different kinds, defective nutrition, or even heredity. Whenever there is a defect in an organism and its functioning it is most important to find the causes, this being the first necessity in order to remove the defect. There are general or indirect and local or direct causes at work, such as endocrine disturbances, nutritional defects, and diseased conditions, both general and local.

GENERAL OR INDIRECT CAUSES.

During recent years heredity has been considered to produce the anomaly in question in different ways, and yet on this point opinions are much divided. Many circumstances argue against heredity, but, on the other hand, in certain cases there appears to be striking proof in favour of it. It is difficult to avoid the suspicion that heredity plays a part, that the defect is congenital, though great if not insuperable difficulties stand in the way of securing full proof. There are at present

no methods of procedure in the study of heredity other than genealogical and statistical, but it is to be hoped that, in the future, both the study of the sex cells and experimental breeding will reveal possibilities at present unknown. In the meantime, therefore, we are not justified in rejecting the possibility of the operation of hereditary factors in sterility, and must always take into account such possibilities. Accordingly, the attention of breeders must be drawn to the fact that breeding should be avoided in families where there appears to be an hereditary tendency to sterility.

As regards the more general causes of reduced fertility, during recent years the view has been brought into great prominence that too intense production has a depressing effect on fertility. It appears very obvious that if cows are treated more as milking-machines than as living organisms, and an attempt is made to concentrate all their energies in the udder and to extort from them the greatest possible yield by milk-stimulating foods, the organism as a whole will be weakened, and thus also the genital system. It is perhaps not easy to prove this by means of figures, but that it is a fact is a matter of general experience and is now universally admitted. Again, the intensely producing herd is generally more susceptible to disease, which might have an indirect effect upon fertility.

In recent years a definite reaction has taken place against this overproduction, as, for example, in the new system of judging Ayrshire dairy cows in Scotland, and it has come to be more generally accepted that in the long-run the ultra-intensive system is economically unsound. From the nutritional point of view, the older workers attributed to feeding a great influence on fertility; in fact, the Swiss worker Zschokke attributed "persistence of the yellow bodies" to feeding on brewers' and distillers' grains. So far, however, no such specific effect can be attributed to these or other feeding-stuffs.

The effect of food, however, is important in many different ways. A general insufficiency, an excess under certain circumstances, a want of balance of the various constituents, an excess of one or a deficiency of another may contribute considerably to this all-important problem by upsetting the endocrine activities, by lowering resistance to disease generally, and by favouring debilitating and depressing effects on the genital tract. A deficient supply of food, or, in other words, a starvation diet, has a marked effect, if prolonged, upon the sex organs, as was found in Germany and Sweden during the war.

Nowadays the food requirements of farm animals are no longer assessed solely in terms of protein, carbohydrates, and fat; other constituents have been proved to be of the greatest importance in nutrition, and these are mainly to be found in the ash or mineral content of the ration. Vitamins or accessory food factors have been described as occurring in certain foods or absent in others, and their function in the metabolic processes or physiological activities has been extensively studied. "Deficiency disease" will therefore result when there is deficiency of one or other of the essential constituents for normal growth and existence.

One must realize that there may be deficiencies which, though not so marked as to cause gross signs of malnutrition or disease, yet may limit the rate of growth, the productivity, or even the fertility of the

individual, in addition to increasing its susceptibility to disease. Veterinarians have devoted themselves to the study of the clinical manifestations of many deficiency diseases, agronomists have interested themselves in the wider general problems of pasture husbandry, and chemists and bio-chemists have sought to find an explanation of such diseases by careful analyses of soils, pastures, foodstuffs, and animal products. In this way a considerable amount of data is now available in many countries of the world which shows the importance of the study of nutrition in both health and disease. The composition of the pasture is reflected in many ways by the productivity, the fertility, and even viability of the animals grazed thereon. The growth-rate of cattle in the natural state is slow as compared with that of domesticated breeds, and the amount of milk produced is limited to that required by the calf. In the natural state, therefore, cows would produce from 200 to 300 gallons in a lactation period, whereas in modern dairy breeds the yield is commonly 750 to 1,000 gallons.

This improvement in the cow must be accompanied by an improvement in the pasture if the higher yields are to be maintained, or obviously a depletion of the soil must result. In many parts of the world this depletion of the land has been permitted to occur by the removal of beef, mutton, milk, wool, and similar animal products, without a corresponding return of the essential elements for adequate plant-growth in the form of chemical fertilizers. This has occurred in the western Highlands of Scotland, in the Falkland Islands, in the pastoral lands of parts of Australia, in India, and obviously to a greater or less extent in all grazing countries. Again, the geological origin of the soil in many countries is responsible for deficiencies in certain minerals, and accordingly if these are not supplied the introduction of improved breeds of live-stock is doomed to failure. Under both circumstances the result will be the same; in the absence of gross signs of disease, a general malnutrition, some degree of emaciation, and impairment of growth occurs, and in full-grown females the breeding-capacity is affected and the milk-yield lowered.

In the valley of the Red River, in Minnesota, the fertility of the cows was low, and a deficiency of phosphorus was shown to occur in the whole district. Lack of ovulation with resulting sterility has been proved to be due to this deficiency, and the feeding of bone-meal or the application of phosphatic manures has resulted in a return to normality. In British Honduras pica or depraved appetite has been noted, sterility is high and milk-yield low; but sufficient evidence has not yet been amassed to definitely establish the cause of the trouble or to furnish a reliable treatment. In Bihar, India, and on the coast of Malabar, where there is a deficiency of phosphorus, mortality among cattle is high, sterility is common, and milk-yield is again low. These, of course, are extreme cases, yet they will suffice to stress the importance of nutrition as affecting the breeding-capacity of bovines. Many more areas could be cited and greater detail given.

LOCAL OR DIRECT CAUSES.

Having thus considered briefly the more general or indirect causes of sterility, we now come to the local or direct causes of this state of affairs. It is unfortunate that here the agreement as to the precise

cause and the best treatment to adopt leaves much to be desired. The causes which favour reduced fertility are to be found in one part or other of the genital tract, as anomalies of the various sex organs, especially the ovaries and uterus or womb. Accordingly this brings us to the parting of the ways with regard to the cause or etiology and treatment of sterility in bovines. Since the problem of sterility in dairy stock has assumed such great importance in the older dairying countries, it is to Denmark and Germany that one must largely look for the necessary assistance in diagnosing and controlling these diverse breeding anomalies.

The German authorities, following Hess, maintain that the seat of the trouble is to be found in the ovaries, and accordingly the chance of success is only to be fostered by ovarian treatment. Hess referred local causes to the ovaries, and found in them "persistent yellow (lutein) bodies" and "cystic degenerations," which could be treated successfully by expression of the yellow bodies and rupture of the ovarian cysts. It was only in cases of purulent metritis that there was any indication for the washing-out of the uterus.

In Denmark Albrechtsen maintained that the uterus or womb was all-important, and thus one was confronted with an endometritic sterility which demanded a purely uterine treatment. This worker considered that the chief and commonest cause of sterility was an inflammatory condition of the uterus, a chronic catarrh. This was assumed to account for the cystic degeneration of the ovaries, and "persistent yellow bodies" were regarded as having no true significance. Accordingly, treatment was confined chiefly to the uterine catarrh, and consisted of antiseptic irrigations, but ovarian cysts were ruptured and "persistent yellow bodies" left untouched. It was considered that expression of the "yellow bodies" would injure the functioning of the ovaries and have a depressing effect on fertility.

At the present time, especially in Europe, a compromise has been arrived at between the two schools, and it is now considered that each individual case must be diagnosed and treated on its own merits. In other words, an individual combined treatment is employed, as first recommended by Stalfors in 1912. On the one hand ovarian treatment, which includes expression of the "persistent yellow bodies," or rupture of the "cysts," may be employed with some measure of success. Stalfors claims 92 per cent. success by expression of the "yellow bodies," and only 80 per cent. by rupture of the "cysts," when no other form of treatment was employed; on the other hand, uterine injections and irrigations alone gave astoundingly good results. To obtain the best results, therefore, a combination of both uterine and ovarian methods of treatment must be employed—in some cases one or other, and in others both methods.

SEX PHYSIOLOGY.

Since a clear understanding of the varying nature of the sterility phenomena can only be acquired by the study of these phenomena in the light of modern scientific sex physiology, it will perhaps not be out of place to review the information regarding the normal physiology of the female animal.

The ovary must be considered the altogether dominating portion of the genital complex, as it exerts a comprehensive influence, not only on the rest of the genital organs, but also on the physical and psychical state of the individual generally. Again, it is to be remembered that this influence is of a chemical nature, due to the activities of the ovaries as an endocrine or ductless gland. The ovarial function is closely associated with the appearance and disappearance of certain different tissue formations within its substance. Within the ovary are to be found thin-walled follicles containing the eggs or ova, which are liberated when ovulation takes place at each œstrum or "heat." The ovum passes down the tubes into the uterus, where fertilization is possible at time of service, when conception occurs. The ruptured follicle now heals over and constitutes the "yellow body" of œstrum or pregnancy, when it persists as a ductless gland of varying size, duration, or activity. The opening from the vagina into the uterus or womb is by way of a short canal, called the cervix, which becomes sealed during pregnancy. The normal occurrence of œstrum or "heat" is regulated by the normal function of the sex glands, probably more especially by the activities of the glandular tissue of the ovary and, as some authorities suggest, probably even by the follicular apparatus.

The glandular tissue of the ovary and also the follicular apparatus are governed by the "yellow bodies" in their cyclical changes. It is evident that normal heat and accordingly ovulation or ovum production must be considered as the all-important side of ovarian activity. Therefore the œstrum occurring in connection with ovulation may be called normal, whereas abnormal heat manifestations may occur in animals which are continuously in heat, or occasionally during pregnancy. The temporal relationship between the occurrence of ovulation and the appearance of heat or œstrum is most important, and in the latest work on the subject it has been suggested as furnishing the explanation of many cases of temporary sterility in bovines. Krupsky and Schmidt recently stated that ovulation takes place during œstrum, and according to Zietschmann it occurs most frequently during the latter part of heat. Nielson, as a result of his extensive examination of normal as well as sterile cows, considers that most probably ovulation really often occurs immediately before or during the first stage of heat, but that the time of ovulation relative to œstrum may, and certainly does, vary considerably. In the cow it is quite easy to imagine that abnormalities of nutrition or disease may occur to such an extent that heat and ovulation do not necessarily accompany or condition each other. In fact, it is important to understand that ovulation frequently occurs without any evident manifestation of heat. According to the Continental workers heatless ovulation in the cow is exceedingly common, and this occurs frequently during the first two or three months after calving. The more lengthy absence of œstrum in the abnormal cow is stated, therefore, to be due to a chronic endometritis or inflammation of the womb. In cows suffering from endometritis heat manifestations after the third month are frequently very irregular; this irregularity increases with the degree of endometritis present, and in very severe cases there is even a complete absence of heat.

CAUSES OF FUNCTIONAL DERANGEMENT.

Having thus considered the physiological derangement which is now generally accepted as causing non-conception, whether on account of ovulation not taking place or by failing to coincide with the outward manifestation of heat, it will next be necessary to outline the many causes responsible for this derangement. This brings us now to the individual animal, and before a clear understanding of the pathogenesis of each individual case can be attained, each part of the genital tract must be considered separately, and the sterilizing anomalies found in each part carefully recorded.

An accurate diagnosis must be arrived at in every case of sterility before any line of treatment can be decided on, as it is imperative to locate the position of the sterilizing anomaly or anomalies. Abnormalities, malformations, and inflammations must be looked for in the ovaries, the tubes, the uterus, the cervix, and in the vagina. In the ovaries cystic degeneration may occur, so-called "persistent yellow bodies," inflammation (oophoritis), tumours, and hormonal defects, both congenital and acquired. In the tubes is usually found an inflammation within or around, which has resulted from an extension from the uterus; within the uterus an endometritis, which may be classified as puerperal—that is, occurring during the three weeks after calving, and catarrhal or chronic.

The Danish school consider that practically all cases of sterility result from an endometritis or inflammation of the womb, and accordingly a considerable amount of information is now available in support of this theory. Cystic degeneration of the ovarian follicles is not invariably accompanied by a catarrhal or purulent endometritis, and according to Professor Nielson the so-called "persistent yellow bodies" are in fact normal cyclical yellow bodies, arising after spontaneous ovulation and regressing in the normal time, but out of all relationship to heat. Expression of these yellow bodies gives rise to a new ovulation in closer temporal relationship to heat, and accordingly conception is more likely to occur.

Finally, sterilizing anomalies of the cervix and vagina include, as before, congenital and acquired deformities, tumours, and inflammations —namely, cervicitis and vaginitis.

As regards both granular and vesicular vaginitis, conditions which were regarded until recently in Germany and elsewhere in Europe as the main cause of sterility, it may be stated definitely that they have little to do with infertility, except perhaps in heifers in very acute cases, when service may be resented and conception made impossible. Yet heifers very badly infected have conceived at first service. Vaginitis may, of course, aggravate a cervicitis, but not necessarily condition such a state.

ENDOMETRITIC STERILITY.

Assuming that all cases are invariably endometritic in origin, the question then arises as to the possibility of infection. In many cases this is definitely established, but in the mild catarrhal state the position is different. This raises the question of whether the antiseptic solutions now used as uterine injections act as disinfectants by destroying the

infection, or merely stimulate the organ. Professor Stalfors, of Stockholm, has taken uterine washing with sterile water by means of a sterile catheter into a sterile vessel, and a bacteriological examination of such washings has failed to show any evidence of infection. Histo-pathological examination of the uterus *post mortem* has occasionally shown evidence of a definite endometritis. Stalfors therefore holds regarding this failure of involution, which is so common, that it is better to talk of an asthenia, weakness, relaxation, or inactivity rather than a uterine catarrh, and that treatment should consist rather of a stimulating or strengthening nature than of a bactericidal.

If this is the true explanation of the condition it is interesting to note that the uterus can be stimulated in many different ways without internal treatment, by massage per rectum, by treatment of the ovaries and of the vagina, &c. Treatment of the vagina has its adherents, and many solutions have been tried, such as methylated spirits, tannin, &c. A definite stimulation of the uterus can be shown to occur, and a much stronger reaction is produced by treatment of the vagina than by treatment of the uterus.

TREATMENT.

When a diagnosis has been arrived at it is essential to plan the treatment in order to remove the sterilizing anomaly, but it can be appreciated that a considerable number of cases will not warrant any intervention, as the condition will of necessity be permanent.

The uterine treatment now generally adopted in Europe is a modification of that introduced by Albrechtsen in Denmark — namely, a simple injection of an iodine solution, usually a solution of iodine in potassium iodide containing one to two parts of iodine per thousand. A catheter is passed into the uterus, and 200 c.c. of the solution is divided between the two horns or branches of the uterus, and usually left in the uterine cavity. Stalfors claims over 80 per cent. success with his individual treatment, and Nielsen in Denmark about 70 per cent., whereas the German authorities seem to have poorer results. In the writer's opinion this might be due to the fact that in Germany the uterine irrigation is carried out by means of a return-flow catheter, whereas at least in Denmark an injection of iodine solution is made into both horns and left in them. The stimulating effect of the iodine both on the uterus and ovaries may be responsible for the greater success attending the latter procedure.

Expression of the "persistent yellow bodies" and rupture of the ovarian cysts is undertaken in selected cases, and great success is claimed for this method of intervention, even in the absence of uterine injection or irrigation.

It should be noted that the treatment here outlined must be carried out by a skilled veterinarian, but in cases of vaginitis the treatment can be undertaken by the owner himself. Mild saline or antiseptic irrigations are indicated, but on no account should they be given just prior to service.

(Series to be continued.)

NOTE.—Temporary sterility will be dealt with in the next article of this series.—ED.

HOGGET MORTALITY AND ITS PREVENTION.

Live-stock Division.

THE experience of the past two seasons in both the North and South Islands has demonstrated that the successful rearing of lambs after weaning—carrying them through the autumn and winter with a minimum of loss—is a subject which requires close attention by sheep-farmers. It must be realized that sound management and feeding of the flock are the main principles upon which to base successful rearing.

With the weaning-period again at hand an attempt should be made to meet any abnormal conditions, prevention being better than cure. The outstanding factors in regard to the mortality in the last two seasons were feed conditions and parasites. These factors were considerably aggravated by the seasonal climatic conditions, in which an increased rainfall associated with mild humid weather resulted in a more or less rank growth of pasture. The unsuitability of such feed for sheep is undoubted. On account of their close-grazing habits short feed, with a fair proportion of fibre to assist in rumination, is the most suitable pasture for sheep of all ages.

Sheep do better when grazing-pastures have been eaten down by cattle. The cattle population has undoubtedly decreased of late years on many farms which in previous years carried sheep without any very serious mortality. Here is one reason for the unsuitable feed conditions in some cases. On low-lying flats with a high carrying-capacity the sheep-pastures are more liable to become contaminated; the pastures become "sheep-sick" on account of the absence of cattle. If heavy growth occurs in the autumn months and sheep are unable to control it, the feed not only becomes unsuitable for them, but also makes excellent cover for the spread and propagation of internal parasites. These unfavourable factors are thus met with by lambs at the most vulnerable period in their life. There is no doubt that when the lambs are weaned, after the loss of the mother's milk and while the rate of growth and the demand for nourishment are both imperative, any set-back, together with a possible infestation with internal parasites, renders the animals typical cases for hygienic attention and treatment.

An important point in this connection is the fact that the early lambs and those which have the best foundation for surviving any critical stage are as a rule drafted off their mothers and killed for the meat-export trade. This only emphasizes the need for greater attention to the feeding of the other members of the flock and those relegated to the cull class by the fat-stock buyer. The far-reaching results of the system of selling off the earliest and best lambs for the fat-lamb trade have been recognized by many farmers. Not only is this important in relation to the constitution of the breeding flock in later years, but other factors such as breeding-capacity and wool-deterioration must be considered.

Lambs should be weaned as early as possible within reason, depending on the season and the state of the pasture available after weaning. Late lambs require special supplementary feeding at time of weaning.

and the encouragement of lambs to take dry nourishing feed is a practice worthy of considerable extension. A salt lick should always be provided. The use of good clover hay in racks, or a daily feed of crushed oats and/or linseed, makes an excellent substitute for the loss of milk. The lambs should be weaned on to as clean pasture as possible, preferably that which has been grazed by cattle. With a scarcity of suitable pastures owing to a shortage of cattle, any clean paddocks which have been under cultivation and are carrying a young grass crop may be used for the lambs. A paddock from which a crop of hay has been saved may be used, provided the feed is not allowed to become rank before use. These remarks apply more particularly to the rich flats where the carrying-capacity is greater than on more hilly country. The lambs should not be put on in too great numbers; overstocking must be avoided. On the hill country there is less difficulty as a rule in regard to parasitic trouble. Low-lying or damp areas of any kind should be avoided for the weaner lambs.

On farms where it is possible to grow early rape, grass, oats, barley, or any other suitable green feed, such feed will give the lambs a good start; late lambs in particular need special treatment. Thousand-headed kale is a useful standby. With any of these supplementary green feeds care is necessary until the lambs become accustomed to the new diet, and it is always advisable to have a run-off on grass. Lambs running on pasture country should be changed regularly. The weaker lambs or hoggets may be separated from the rest of the flock and put on feed of a more invigorating nature. Young lambs may be taught to feed from troughs or racks while still suckling their mothers, so that when weaning takes place such feeding may be continued and increased. Self-feeders would prevent the necessity for daily attention by the farmer or shepherd.

A practice which has been followed with considerable success in some districts is that of grazing the paddocks first with the older sheep, and afterwards with the lambs and younger sheep. This practice has had to be adopted where no clean pastures were available upon which to wean the lambs. It may be here argued that the older sheep have in this way every opportunity of contaminating the pastures with the eggs and embryos of parasites, but the counteracting factor is that the feed is rendered more suitable for the young stock. This advantage appears to outweigh any disadvantage.

The higher country has many advantages over the rich flats in a rainy mild autumn. The drier soil with its less luxuriant growth and also with a lesser tendency to the spread of parasites is more suitable for the younger sheep when clean pastures cannot be obtained on the flats. On the flats, where the carrying-capacity is high, the possibilities of closer subdivision with rotational grazing are considerable. Under this system not only would a frequent change of pasture be provided, but the pasture could be better kept in control, and any long luxuriant growth could be shut up and utilized for the production of ensilage and hay for winter feeding. Moreover, such areas would provide a fairly clean pasture upon which to wean lambs. The conserved herbage would be put to better advantage in providing winter fodder than by being trampled down.

With regard to the treatment which may be adopted once evidence of parasites is obtained, in the first place it must be again mentioned

that a sick sheep is difficult to treat either medicinally or by increased dieting. Lambs should be taught to feed early, and extra feeding is one of the main factors in the treatment of parasites. Medicinal agents can be relied upon only as subsidiary to the feeding and management precautions already outlined. Adult sheep harbour parasites, and the ova or eggs reach the pasture, where under suitable conditions of temperature and moisture the larvæ hatch out and are swallowed by animals grazing such pastures. The symptoms set up and the losses met with, especially in young animals, are fairly well known.

Several agents have been used for dosing infested sheep. Probably that most commonly used and proved to be effective against the stomach-worm is a 1-per-cent. solution of copper sulphate (bluestone). The dose varies with the age of the sheep to be dosed, from 6 drams for a young lamb to 3 oz. for an adult sheep. Early dosing as soon as possible after weaning is quite essential in a rainy autumn. Dosing can be repeated every three weeks. Other agents used include turpentine, which may be given in milk or in raw linseed-oil. If given in oil a little soda may be added and the whole made into an emulsion. From a teaspoonful to a dessertspoonful may be given to each animal, depending on its age. Besides its vermicidal properties, turpentine in medicinal doses appears to have a stimulating effect in the case of weak animals. There are numerous other preparations used for worms in sheep, but those just mentioned are most commonly employed.

In conclusion, the factors concerned in the prevention of hogget mortality may be summarized as follows:—

(1) Wean lambs early on to clean pasture, if available.

(2) Pastures which have been grazed by cattle are most suitable.

(3) If clean pastures are not available the lambs should be taught to feed from troughs before or after weaning, weaned on to the driest paddocks, and supplementary feeding increased after weaning.

(4) In wet seasons early dosing soon after weaning is advisable, to be repeated as necessary.

(5) Avoid overstocking with the young animals.

(6) The possibilities of closer subdivision of paddocks, rotational grazing, the shutting-up of paddocks in case of heavy growth, and the utilization of the herbage as ensilage or hay, offer great possibilities for providing a clean area upon which to wean lambs.

(7) Where arable farming is carried out in the production of supplementary green crops a clean area should be obtainable upon which to wean lambs.

(8) Late lambs require more attention than early lambs; sick lambs are the most difficult to treat.

Careful observation for the first indications of going off in health and condition are necessary, and one of the essentials is to train the young animals to take good dry feed while they are fit and well, so that if a flush of unsuitable autumn feed comes about the unfavourable feeding conditions can be corrected by a ration of good dry feed, which the hoggets will then take readily. If not trained to dry feed, and an attempt is made to get them on to it after sickness has manifested itself, usually they will not take it at all, with a resultant heavy mortality.

GORE EXPERIMENTAL AREA.

RECORD OF THE 1928–29 SEASON'S WORK.

R. B. TENNENT, Fields Superintendent, Dunedin.

DURING the season of 1928–29 considerable investigational work was carried out at the Gore Experimental Area in regard to the manurial practices adopted for various crops in that part of Southland. The chief objective so far as the individual experiments were concerned was an endeavour to ascertain by exact experimental methods the differences which occurred in crop-growth as a result of the application of various fertilizers. To this end the old subdivisions of the Area were discarded and larger-sized blocks pegged out, in order to allow sufficient room for a large number of replications of each experiment. Generally speaking the season proved an excellent one, and growth was good in all plots throughout the year. The spring, however, was if anything wetter than is normal, consequently the supposedly deleterious effect of superphosphate on the germination of turnip and swede seed was not noticed.

Particulars of the various experiments are given in the following matter.

Swede Manurial Trials (Block 1).

Four experiments, designated A, B, C, and D, were conducted on this block. Hunsballe variety of swede-seed was used in Experiments A, B, and D, sown in 26 in. ridges at the rate of 20 oz. per acre. This seed, of Danish origin, germinated at 82 per cent. In the case of Experiment C, Webb's Masterpiece swede was sown.

Experiment A.

The object of this experiment was to ascertain the effect upon germination and subsequent growth of swede-seed when varying quantities of superphosphate were sown in direct contact with the seed. The experiment was sown down on 9th November, 1928. Each treatment, consisting of two drills, was replicated ten times. Experience in Canterbury indicated that the practice of sowing superphosphate in large quantities in direct contact with the seed had a damaging effect upon its germination, and in this experiment an attempt was made to definitely ascertain the amount of super which could be thus sown without such injury proving of much moment. In addition the effect of mixing super and lime was also put under trial, on the assumption that such a mixture could be sown with impunity so far as germination injury is concerned.

Treatments per acre were carried out as shown in Table 1, the carbonate of lime and super being mixed three weeks prior to sowing. The super used in this and other trials here recorded was 44.46 per cent. grade.

The crop was weighed on 23rd May, 1929, and at that date was fairly heavily infected by club-root and dry-rot. Germination counts were taken when the young plants were in the two-leaf stage; each

number given in Table 2 is an average of 100 counts on a 10 ft. length of one row. Each yield-figure given represents an average of sixty weighings of ½-chain length in one row.

Table 1.

No.	Treatment.	Rear Box.	Front Box.	Total.
		Cwt.	Cwt.	Cwt.
1	Super 3 cwt.	..	3	3
2	Super 3 cwt.	¼	2¾	3
3	Super 3 cwt.	½	2½	3
4	Super 3 cwt.	1	2	3
5	Super 3 cwt., lime 3 cwt. ..	1	5	6

NOTE.—Manure from rear box of ridger falls with seed; manure from front box falls below seed.

Table 2.

No.	Treatment.	Average Number of Plants per 10 ft. Row (100 Counts).	Relative Germination.	Yield in Tons per Acre.
			Per Cent.	
1	Super	54·5	100	27·8
2	Super	36·8	67	25·9
3	Super	43·1	79	28·3
4	Super	36·7	67	26·1
5	Super + lime ..	50·9	94	29·2

So far as the germination counts are concerned it is to be noted that any difference greater than 5·5 plants per 10 ft. is significant. It will be observed that apparent inconsistencies occur in the treatments where ¼ cwt. and 1 cwt. of super sown with the seed have lowered germination to a greater extent than where ½ cwt. of super was sown. This is at present inexplicable, and further investigations will be made. In regard to yield, Treatment 2 gives a significantly lower yield than Treatment 1; Treatment 4 is significantly lower than Treatment 3; Treatments 1 and 5 do not differ significantly. It will also be observed that those plots having the lowest germination have the lowest yields.

Experiment B.

Sown down on 13th November, 1928, this experiment was designed to determine the effect of varying proportions of super plus lime when sown in contact with the seed, and to compare that mixture with super plus Ephos phosphate plus lime in germination and yield. Twelve replications of each treatment were carried out.

Table 3 shows the treatments per acre, the carbonate of lime and super being mixed three weeks prior to application.

The crop was weighed on 24th May, 1929, each yield recorded being an average of fifty weighings of one row by ½ chain in length. The germination counts are averages of 104 counts on a 10 ft. length of one row. Results are given in Table 4.

At the date of weighing portion of the crop was badly infected with club-root, and consequently weighings were taken from five replications only. Germinations may be regarded as not differing significantly

Table 3.

No.	Treatment.	Rear Box.	Front Box.	Total.
		Cwt.	Cwt.	Cwt.
1	Super 3 cwt., lime 3 cwt. ..	..	6	6
2	Super 3 cwt., lime 3 cwt. ..	½	5½	6
3	Super 3 cwt., lime 3 cwt. ..	1	5	6
4	Super 3 cwt., lime 3 cwt. ..	2	4	6
5	Super 1½ cwt., Ephos 1½ cwt., lime 1½ cwt.	¾	3¾	4½
6	Super 1½ cwt., Ephos 1½ cwt., lime 1 cwt.	1	5	6

Table 4.

No.	Treatment.	Average Number of Plants per 10ft. Row (104 Counts).	Yield in Tons per Acre.
1	Super + lime	53·0	26·7
2	Super + lime	54·9	25·1
3	Super + lime	55·9	27·6
4	Super + lime	51·0	22·6
5	Super + Ephos + lime 1½ cwt. ..	52·6	26·9
6	Super + Ephos + lime 3 cwt. ..	50·2	23·4

from one another, but in regard to yields Treatment 4 is significantly lower than Treatment 3. This appears to be inconsistent with the fact that Treatment 3 is superior to Treatment 2. Treatment 5 is significantly better than Treatment 6. Unless these results were due to the effect of extra lime reducing the efficiency of Ephos, it is difficult to explain them.

Experiment C.

In this experiment an endeavour was made to determine the relative merits of various phosphates when sown alone or in conjunction. The effect of super plus lime compared with these mixtures was also put under trial. The experiment was laid down in twelve replications of each treatment on 15th November, 1928, in this case Webb's Masterpiece variety being sown. The following treatments were applied :—

Table 5.

No.	Treatment.	Rear Box.	Front Box.	Total.
		Cwt.	Cwt.	Cwt.
1	Super	½	2½	3
2	Seychelles phosphate	½	2½	3
3	Ephos	½	2½	3
4	Super 1½ cwt., Ephos 1½ cwt. ..	½	2½	3
5	Super 3 cwt., lime 3 cwt. ..	1	5	6

Germination counts were taken on 21st December, 1928, and the crop finally weighed on 9th August, 1929. At the date of weighing the swedes were badly infected with dry-rot, but less club-root was present than was the case in Experiments A and B. Each yield represents an average of seventy-two weighings of one row by ½ chain in length. The following table gives results :—

Table 6.

No.	Treatment.	Average Number of Plants per 10 ft. Row (108 counts).	Relative Germination.	Yield in Tons per Acre.
			Per Cent.	
1	Super	41·2	86	36·5
2	Seychelles phosphate ..	44·1	92	35·6
3	Ephos	44·2	92	35·0
4	Super 1½ cwt., Ephos 1½ cwt.	46·6	97	36·4
5	Super 3 cwt., lime 3 cwt.	48·1	100	37·4

In regard to the figures relative to germination it is to be noted that any difference greater than 3·2 plants per 10 ft. may be regarded as significant. Although Treatments 2 and 3 are barely significantly better than No. 1, the difference is probably a real one. So far as the yield results are concerned that given by Ephos is significantly lower than those of super, super plus Ephos, and super plus lime. Seychelles does not differ significantly from super.

Experiment D.

The chief object in regard to this experiment was to determine the effect on germination and yields when using potash as an adjunct to super alone and in conjunction with lime, and at the same time to ascertain the effect on swedes of nitrogen in the form of dried blood. The seed was sown on 14th November, 1928, each plot being replicated twelve times. The following treatments per acre were given, the manures being mixed three weeks previous to sowing :—

Table 7.

No.	Treatment.	Rear Box.	Front Box.	Total.
		lb.	lb.	Cwt.
1	Super 3 cwt.	56	280	3
2	Super 3 cwt., lime 3 cwt.	112	560	6
3	Super 3 cwt., lime 3 cwt. + 30 per cent. potash 1 cwt.	131	653	7
4	Super 3 cwt., lime 3 cwt., potash 1 cwt., blood 1 cwt.	149	747	8
5	Super 3 cwt., 30 per cent. potash 1 cwt.	75	373	4

In this experiment dry-rot and club-root were present to a slight extent. Weighings were taken on 5th and 6th July, 1929, each yield-figure in Table 8 representing an average of seventy-two weighings of one row by ½ chain in length. Germination counts were also taken at the same time as in the previous experiments. The following yields and counts were recorded :—

Table 8.

No.	Treatment.	Average Number of Plants per 10 ft. of Row (108 counts).	Relative Germination.	Yield in Tons per Acre.
			Per Cent.	
1	Super	41·2	91	39·8
2	Super + lime	45·1	100	38·9
3	Super + lime + potash..	39·5	88	45·6
4	Super + lime + potash + blood	39·4	88	45·0
5	Super + potash ..	37·8	84	45·2

In regard to the germination results, any differences greater than 3·6 plants per 10 ft. may be regarded as significant. Potash apparently has had a slight effect on germination, which appears to be worst when used in combination with super alone. All plots are significantly higher in yield than Treatments 1 and 2. Neither lime nor blood have influenced yield, which is rather the reverse to general experience.

Grass-seed Origin and Strain Trial (Block 2).

This block of 5 acres in extent is at present laid down to various strains of rye-grass, sown in conjunction with different species of other grasses. It is not intended to give particulars of this experiment in the present report, as it will be dealt with at a later stage by the Agrostologist, who is directly conducting the experiment.

Oats Manurial Experiment (Block 3).

Three experiments—A, B, and C—were sown down in this block, a commercial sample of Garton's oats being used for the purpose. All seed was pickled prior to sowing, and a good germination was experienced throughout.

Experiment A.

This experiment consisted of a simple trial of varying quantities of super as compared with no-manure and Ephos, the treatments being sown out with the seed on 30th October, 1929. Each plot was replicated ten times, and harvested and weighed on 9th March, 1929. On 25th March further weighings were made to determine the loss in moisture which had taken place from the date of cutting until the date of stacking. All weights given in Table 9 indicate the amount of chaff per acre. In regard to the yields, it is to be noted that each figure is the average of twenty weighings.

Table 9.

Treatment per Acre.	Yield per Acre.	Increase over No-manure.	Weight when ready to stack as Percentage of Weight when cut.
	Tons.	Tons.	Per Cent.
No manure	2·29	..	55
Super 1 cwt.	2·55	0·26	56
Super 2 cwt.	2·65	0·36	55
Ephos 2 cwt.	2·23	..	54

At the date of harvesting smut was prevalent throughout. The superphosphate plots were much taller in growth and more mature than the Ephos and no-manure plots, which were about equal, both being badly infested with yarr (*Spergula arvensis*). The plot sown with super at the rate of 2 cwt. per acre appeared best throughout. The super 1 cwt. and 2 cwt. increases are both significant, but do not differ from one another to a significant extent.

Experiments B and C.

These concerned the trial of different methods of applying nitrogen and the use of different forms of nitrogen. At the present stage results are not sufficiently conclusive to warrant publication.

Turnip Manurial Trials (Block 6).

Three turnip manurial trials were laid down on exactly similar lines to those of the swede trials already recorded. The trials were sown with Aberdeen Green-top yellow turnip at the rate of 20 oz. per acre, each plot consisting of two rows replicated ten times. As the object of each experiment has already been dealt with in connection with swedes, results of field germinations and yields only will be given in this section.

Experiment A.

This was laid down on 21st November, 1928. Germination counts were taken on 20th December, and the crop weighed on 18th and 20th June, 1929. The following treatments per acre were given, carbonate of lime and superphosphate being mixed in the case of this experiment, and also in B and D, approximately three weeks prior to owing.

Table 10.

No.	Treatment per Acre.	Rear Box.	Front Box.	Total.
		Cwt.	Cwt.	Cwt.
1	Super 3 cwt.	..	3	3
2	Super 3 cwt.	¼	2¾	3
3	Super 3 cwt.	½	2½	3
4	Super 3 cwt.	1	2	3
5	Super 3 cwt. + lime 3 cwt. ..	1	5	6

Results of field germination and yields were as follows:—

Table 11.

No.	Treatment.	Average Number of Plants per 10 ft. Row (100 Counts).	Relative Germination.	Yield in Tons per Acre.
			Per Cent.	
1	Super	36·6	89	28·2
2	Super	40·1	97	28·6
3	Super	35·5	86	28·4
4	Super	26·5	64	28·5
5	Super + lime ..	41·2	100	29·2

Each yield is an average of sixty weighings of one row by $\frac{1}{2}$ chain. In regard to the germination figures recorded any difference greater than three plants per 10 ft. may be regarded as significant. The increased germination of Treatments 2 and 3 over Treatment 1 is unusual and difficult to understand. In regard to the yield-figures there are no significant differences.

Experiment B.

This plot was sown down on 21st November, 1928, germination counts being taken on 21st December, and weighings made on 18th and 20th June, 1929. Treatments per acre and field germination and yields are given in Tables 12 and 13 respectively.

Table 12.

No.	Treatment per Acre.	Rear Box.	Front Box.	Total.
		Cwt.	Cwt.	Cwt.
1	Super 3 cwt. + lime 3 cwt.	..	6	6
2	Super 3 cwt. + lime 3 cwt.	$\frac{1}{2}$	$5\frac{1}{2}$	6
3	Super 3 cwt. + lime 3 cwt.	1	5	6
4	Super 3 cwt. + lime 3 cwt.	2	4	6
5	Super $1\frac{1}{2}$ cwt. + Ephos $1\frac{1}{2}$ cwt. + lime $1\frac{1}{2}$ cwt.	$\frac{3}{4}$	$3\frac{3}{4}$	$4\frac{1}{2}$
6	Super $1\frac{1}{2}$ cwt. + Ephos $1\frac{1}{2}$ cwt. + lime 3 cwt.	1	5	6

Table 13.

No.	Treatment.	Average Number of Plants per 10 ft. Row (100 Counts).	Yield in Tons per Acre.
1	Super + lime	35·3	11·4
2	Super + lime	32·6	11·9
3	Super + lime	34·8	11·3
4	Super + lime	31·9	11·6
5	Super $1\frac{1}{2}$ cwt. + lime $1\frac{1}{2}$ cwt. + Ephos $1\frac{1}{2}$ cwt.	38·7	11·2
6	Super $1\frac{1}{2}$ cwt. + lime 3 cwt. + Ephos $1\frac{1}{2}$ cwt.	31·2	11·4

Each yield given in Table 13 is the average of thirty-three weighings of two rows by $\frac{1}{2}$ chain. In the germination figures any difference greater than three plants per 10 ft. may be regarded as significant. The reasons for the differences in germination which occur are inexplicable, and seem to point to irregular sowing. This is a point which will be investigated during the present season. No significant differences are recorded in regard to yield. Club-root proved bad throughout the plot, thus affecting the yield.

Experiment D.

Sown down on 22nd November, 1928, germination counts were taken on 21st December, and the crop harvested on 18th and 20th June, 1929. Table 14 gives the treatments per acre.

Table 14.

No.	Treatment per Acre.	Front Box.	Rear Box.	Total.
		lb.	lb.	Cwt.
1	Super 3 cwt.	56	280	3
2	Super 3 cwt. + lime 3 cwt. ..	112	260	6
3	Super 3 cwt. + lime 3 cwt. + 30 per cent. potash 1 cwt.	131	653	7
4	Super 3 cwt. + lime 3 cwt. + potash 1 cwt. + dried blood 1 cwt.	149	747	8
5	Super 3 cwt. + potash 1 cwt. ..	75	373	4

Results of field germination and yields were as follows :—

Table 15.

No.	Treatment.	Average Number of Plants per 10 ft. Row (100 Counts).	Yield in Tons per Acre.
1	Super	36·6	29·5
2	Super + lime	38·2	29·2
3	Super + lime + potash ..	41·0	29·3
4	Super + lime + potash + blood	35·3	31·2
5	Super + potash	25·5	28·6

In this experiment each yield is the average of sixty weighings of one row by ½ chain. In the germination figures any difference greater than 2·8 plants per 10 ft. may be regarded as significant. The increased germination of Treatment 3 appears to be abnormal, and may be accounted for by uneven seeding. It is obvious that too much reliance cannot be placed on germination results. The only difference in yield is in the increase due to the use of dried blood (Treatment 4). Potash appears to have had no effect (compare with effect in Experiment D on swedes). On this plot only a slight trace of club-root and dry-rot was present.

Mangel Manurial Trial (Block 8).

Block 8 was devoted to a mangel manurial trial, with the object of determining the effects of various manures on yield, and to obtain some indication as to the possibility of such manures affecting the germination of mangel-seed. The plot was sown down on 4th November, 1928, and germination counts were taken on 20th December. The crop was finally weighed on 10th, 14th, and 17th June, 1929. The land is of a heavy clay-loam nature, previously in grass for a considerable number of years. The variety of mangel sown was Webb's Prizewinner, and the rate of seeding 4 lb. per acre. Each plot consisted of two rows, there being twelve replications of each treatment.

On the day preceding sowing alternate strips of agricultural salt were sown in 16 ft. widths at the rate of 3 cwt. per acre, there being five strips with salt and five without. These were sown at right angles to the manurial treatments. The following treatments were given :—

Table 16.

No.	Treatment per Acre.	Rear Box.	Front Box.	Total.
		Cwt.	Cwt.	Cwt.
1	Super 4 cwt.	1	3	4
2	Super 4 cwt. + 30 per cent. potash 1 cwt.	1¼	3¾	5
3	Super 2 cwt. + Ephos 2 cwt. ..	1	3	4
4	Super 2 cwt. + Ephos 2 cwt. + potash 1 cwt.	1¼	3¾	5
5	Super 2 cwt. + Ephos 2 cwt. + potash 1 cwt. + nitrate of soda (top-dressed later)	1¼	3¾	5 cwt. + nitrate of soda.
6	Super 4 cwt.	½	3½	4

NOTE.—The nitrate of soda was top-dressed on 18th December at the rate of 147 lb. per acre.

Field germinations were as follows:—

Table 17.

No.	Treatment.	Average Number of Plants per 10 ft. Row (108 Counts).	Relative Germination.
			Per Cent.
1	Super	43·9	87
2	Super + potash	43·3	86
3	Super + Ephos	49·2	98
4	Super + Ephos and potash ..	45·6	90
5	Super + Ephos + potash + nitrate of soda after counting	42·3	84
6	Super	50·5	100

In regard to the germination figures, any difference greater than 4·5 plants per 10 ft. is significant. An amount of 1 cwt. per acre of super used in contact with the seed has reduced the number of plants by 6·6 per 10 ft. below the number growing when only ½ cwt. of super was sown with the seed. Treatments 3 and 6 have the same amount of super sown with the seed—namely, ½ cwt. per acre, and show germinations practically equal. Treatment 4 is not significantly lower in number of plants than Treatment 3, although Treatment 5 is lower. Taking Treatments 4 and 5 together the germination injury due to potash becomes significant, although its effect is not apparent when Treatment 2 is compared with Treatment 1. As a result of this trial it would appear that mangel-seed is susceptible in small degree to germination injury by manures of a soluble nature.

Table 18 shows the yields obtained as a result of the various applications of fertilizers, each yield being an average of fifty weighings of two rows 16 ft. in length.

Treatments 5 and 6 gave significantly better yields when used on ground treated with salt than where no salt was used. Treatments 1, 3, and 4 show increases due to salt, though not to a significant extent. Treatment 2 (super + potash) has given a significantly better yield when used without salt than with it.

Table 18.

No.	Treatment per Acre.	Yield per Acre.		Difference in Favour of Salt.	Significant (S.), or Non-significant (N.S.).
		With Salt.	Without Salt.		
		Tons.	Tons.	Tons.	
1	Super	24·7	23·4	1·3	N.S.
2	Super + potash	23·2	24·2	1·0	S.
3	Super + Ephos	26·4	25·0	1·4	N.S.
4	Super + Ephos + potash ..	24·4	23·5	0·9	N.S.
5	Super + Ephos + potash + nitrate of soda top-dressed	26·2	25·0	1·2	S.
6	Super	28·9	26·5	2·4	S.

The yields of Treatments 2 and 4 are significantly lower than those of Treatments 1 and 3 respectively on salt-treated ground. Without salt Treatment 4 is significantly lower in yield than Treatment 3, but Treatment 2 does not differ significantly from Treatment 1. Hence potash has depressed yield in three out of four comparisons. Treatment 5 is significantly better than Treatment 4 on salted ground. The same treatments on unsalted ground show a barely significant difference. It is fairly safe to conclude that nitrate of soda has caused a slight increase in yield, although it has only just compensated for the depression due to potash. It will be noticed that Treatments 3 and 5 are practically the same in yield. Treatment 6 has given a significantly better yield than all the others. Consequently it appears that there is a fairly low limit to the amount of soluble fertilizer which should be applied in contact with the seed on this class of soil.

From the foregoing experiment it will be noticed that mangel-growing can be considered as a payable proposition on country similar to that where the experiment was conducted. In view of the fact that club-root and dry-rot are proving such a serious drawback to the growing of turnips and swedes, it would appear that more consideration should be given to the growing of mangels on ground thus affected.

Potato Manurial Trial (Block 4).

A manurial experiment on potatoes was conducted on this block, with a view to ascertaining the effectiveness of various fertilizers when sown with the crop. The experiment was planted on 2nd October, 1928, on soil of a heavy clay-loam nature, and dug on 2nd, 3rd, and 4th May, 1929. Six replications of each treatment were carried out, and yields as shown in Table 19 were obtained.

Growth throughout was quite good, and, as will be observed from the yield figures, the effect of sulphate of potash considerably increased the yield. It would thus appear that in this Gore soil-type potash is a limiting factor in so far as the growing of potatoes is concerned. Before weighing it was very noticeable that the haulms in Treatments 4 and 5 were much denser than in other treatments. The potatoes lifted from those rows so treated were of a decidedly better quality and size. Two lines of seed were used in this trial, one being certified Arran Chief from Canterbury and the other a locally grown line of Arran Chief containing a fair proportion of Northern Star rogues.

Table 19.

No.	Treatment per Acre.	Yield per Acre.			Total.
		Table Size.	Seed Size.	Small Size.	
		Tons.	Tons.	Tons.	Tons.
1	No manure	1·2	1·3	3·2	5·7
2	Super 3 cwt.	1·2	1·2	3·2	5·6
3	Super 3 cwt. + sulphate of ammonia 1 cwt.	1·3	1·3	3·5	6·1
	The above yields do not differ significantly from one another.				
2	Super 3 cwt.	1·2	1·2	3·2	5·6
4	Super 3 cwt. + sulphate of potash 1 cwt.	3·0	2·3	3·3	8·6
	Significant increase of No. 4 over No. 3	1·8	1·1	..	3·0
4	Super 3 cwt. + sulphate of potash 1 cwt.	3·0	2·3	3·3	8·6
5	Super 3 cwt. + sulphate of ammonia 1 cwt. + sulphate of potash 1 cwt.	2·8	2·5	3·9	9·2
	Significant increase of No. 5 over No. 4	..	..	0·6	..

Club-root Trials (Block 4).

The incidence of club-root in turnips in Southland has in the past been of such a serious nature that turnip-growing in certain districts has become a most precarious undertaking. Despite frequent applications of lime to the soil in which turnips are grown this disease still causes great annual loss, and consequently every step is being taken to ascertain some effective method of reducing the damage so occasioned.

An interesting trial was conducted on the Area during the past year, consisting of a test of varieties of swede turnips reputed to be highly resistant to club-root. Two Danish varieties were put under trial, these being separate strains of Bangholm Purple-top swede — namely, Herning and Hunsballe VI. These two strains of Bangholm swedes were compared with two standard commercial varieties commonly grown in Southland, designated in this record Commercial A and Commercial B. Seed of the four varieties was sown in plots 2 chains in length, each plot consisting of four drills of each variety. The plots were replicated twelve times. Prior to sowing on 24th November, 1928, the seed of each variety was treated by the Department's Field Mycologist for dry-rot, and sown at the rate of 1 lb. per acre.

Although no germination counts were taken, a good even germination occurred with each variety, there being no visible differences to record. From the time of germination until the beginning of January growth throughout proved fairly even and regular. At the time of thinning, however, during the middle of January, it was noticeable that each variety of swede was badly infected with club-root, with the exception of the Herning strain. At the beginning of February each of the varieties had completely died out with club-root, with the exception of Herning, which continued to grow vigorously. Only a

few isolated plants of the remaining varieties remained, forming a striking contrast to the dense rows of well-grown Herning bulbs.

A final examination of the block was made on 22nd May, 1929. By this time Herning was the only variety left growing, and a close examination was carried out to ascertain the percentage of club-root and dry-rot infection present. Of 741 roots examined 145 proved to be infected with club-root and 313 infected with dry-rot. The yield from the crop of Herning was estimated at 26 tons 13 cwt. 3 qr. per acre, whereas no yield was obtained from the other varieties.

In view of the fact that this trial was conducted on land heavily infected with club-root, there is ample evidence that the Herning strain of Bangholm Improved Purple-top swede is highly resistant to the disease. It is not immune, however, from club-root or dry-rot. There can be no question that this particular variety is a most valuable one for Southland conditions, and further trials in regard to its disease-resisting capacity are being arranged. It is of interest to record that in a trial of eighteen varieties of swedes conducted at Tapanui Herning gave the second highest yield, proved of good keeping-quality, and was well liked by stock.

Effect of Lime on Crops (Block 7).

Block 7 is being utilized for an extended trial of the effect of lime on various crops extending over a number of years. No report on this experiment, however, will be given until the completion of the trial.

Green Manuring with Lupins (Block 5).

For the purpose of improving the soil conditions and fertility of Block 5, a crop of blue lupins was sown in the spring and ploughed in during January. The crop was drilled at the rate of 2½ bushels, together with 2 cwt. of super, per acre, and grew excellently. The practice of ploughing in a crop of lupins on one block each year will be continued.

Acknowledgment is made of the excellent service rendered by the Overseer, Mr. J. Sleeman, and to the Crop Experimentalist for assistance and advice in connection with the various experiments.

Separation of Milk at Varying Temperatures.—During the 1928-29 season a series of experiments was carried out by the Dairy Research Institute, at Palmerston North, to determine the effect of separating milk at low temperatures and to ascertain whether the usual loss of butterfat at such temperatures can be economically avoided. The annual report of the Director of the Institute states: "It was shown that at temperatures of separation below 80° F. the loss of fat is fairly considerable, but not sufficient to merit the employment of expensive methods of heating. It was also shown that at low temperatures of separation the cream test was increased. Further, the experiments prove that the loss is greatest when the cows are far advanced in their lactation period. Hence the time at which farmers need to pay very particular attention to the temperature of their milk is towards the close of the dairying season, when cows are nearing the end of their lactation and atmospheric temperature is below normal."

SEASONAL NOTES.

THE FARM.

The Pastures.

In February mowing of pasture may be advisable because of one or more of several sets of circumstances. Thus it may be necessary to remove the flower-heads of perennial weeds; or it may be advisable to "top" portions of pasture-growth which are rank and producing seed, in order to induce the development of fresh growth from the base of the topped plants. Sometimes pastures are overrun with large numbers of shade-creating weeds such as spear-thistles, docks, fat-hen, and redshank or willow-weed. If these weeds receive no attention they are likely to greatly weaken the pasture plants in their immediate vicinity, and possibly create vacant patches on which inferior plants may become established. If, however, they are mown they cease to create the shade which injures the valuable pasture plants.

Over a wide range of conditions some at least of the grassland on farms may well have phosphates applied in February or thereabouts. When the soil-moisture is sufficient the application of phosphates at this period stimulates extra valuable fresh growth, and the phosphates will continue their stimulation of the grass during the following spring, so that a grass-growth more even over the whole year results.

The preparation of the ground for autumn sowing of pastures is an important summer task. A good seed-bed for this purpose is fine and firm. These characters, and particularly firmness or consolidation, cannot be secured readily unless the work is commenced in good time. Clovers, which are vital to successful permanent pasture, call particularly for consolidation. The value of a firm seed-bed is well exemplified in the fact that the best pastures are often to be found round the headlands, where there has been the greatest amount of consolidation by the passage of horses and implements.

There is being enacted a silent revolution in the matter of determining the ingredients of pasture-seed mixtures. For generations the natural plant-food supply of the soil has been a prime consideration when deciding upon a grass-seed mixture. Now that the farmer has available the wide field of pasture top-dressing as a handmaid, the ingredients of a seed mixture may be determined not so much by the initial fertility of the soil as by the rainfall it receives. In brief, it is often proving more profitable to bring the fertility of the soil up to the requirements of a high-class seed mixture by suitable top-dressing, rather than to frame a seed mixture with requirements down to the natural unimproved fertility of the soil. In conformity with this policy, land the fertility of which is better fitted to the requirements of cocksfoot than those of perennial rye-grass may nevertheless, on sound lines, be given a mixture suited to develop a rye and white clover dominant pasture, there being an underlying intention to bring the fertility up to rye-grass requirements by suitable top-dressing. Because of this change in outlook seed mixtures which were considered the best a few years ago for certain conditions may not now be so considered. Farmers who desire to keep abreast of recent developments in this connection may find it worth while to seek the advice available from local officers of the Fields Division of the Department of Agriculture.

In districts subject to grass-grub depredations it is advisable to avoid the sowing-down of pastures after a cereal or previous crop of grass; the less plant-covering land carried during the November to January period the more likely is it to be free from the grub.

A February Feeding Weakness.

In some of the most favoured dairying districts the daily butterfat production of February is in normal seasons only about 75 per cent. of what it was in December. It is not natural for cows, even animals which are not of particularly good dairy type, to fall off in production at such a rapid rate, and in such cases it can be taken that there is something wrong with the management. Investigation has disclosed that it is the feeding that is at fault. The weakness is usually not so much one of deficiency in quantity as deficiency in quality—there is usually an ample supply of feed of a sort, but it is not of the type which begets efficient butterfat-production. Usually there is too low a proportion of the class of essential substances known as proteins, which cannot be replaced by an oversupply of other classes of nutritive substances. Frequently also the feed is not sufficiently digestible to secure the best production from dairy cows. If cows given feed of this type are at all inclined to beef, they will immediately commence putting fat on to their frames rather than into the bucket. They will be condemned, when it is the feeding of them which should be condemned. Conditions which favour body-fat production rather than butterfat-production occur when the animals are being fed pasture that is too long and mature, or overmature special forage crops such as maize and millet, or ensilage saved from grass that was cut when it was too mature. In all these cases a feed badly balanced for butterfat-production is being provided. It can be taken that once flower-stalks have developed on any one of the crops mentioned, that crop is beyond the best stage of feeding for butter-fat production. The badly balanced feeding can be avoided in February primarily by keeping the pastures short and leafy.

Other very useful February measures are the feeding of young succulent lucerne or red clover before it has developed much woodiness and before there is any flower-production, the feeding of young millet, and the feeding of soft turnips. Some of these crops would produce heavier yields possibly by leaving them longer unutilized, but by so leaving them they would provide either a badly balanced forage or one not so greatly needed when the time comes to use it.

The Breeding-ewes.

In the North Island farmers who propose to raise fat lambs usually put out the rams at the end of February or early in March. If there is a likelihood of the ewes being too fat they should be put on short rations early enough to have reduced their condition sufficiently. Flushing the ewes for a week or ten days before the rams go out is of value. Flushing can be effected by providing some succulent food, such as rape after the first feeding-off of the lambs, or by putting the ewes on the best short pastures available.

Seasonable Forage-crop Work.

Valuable work in connection with forage-crop production can, if necessary, be carried out during the coming few weeks. In many localities there is still time to sow turnips. Imperial Green Globe, Hardy Green Globe, and White Stubble turnip are generally suitable for sowing at this time. Swedes are less satisfactory for late sowing partly because of greater possible ravages from the insect pests, especially should a dry autumn occur. There will, in many instances, be available vacant land which offers splendid opportunity for the growing of forage which would become available during times of possible shortage. For instance, land in oat stubble, if worked as soon as the crop is removed and then sown in Western Wolths rye-grass and red clover, will provide autumn and winter feed which is often quite valuable, especially to sheep-farmers operating under Canterbury or similar conditions. Black Skinless barley sown at the rate of 2½ bushels per acre develops so quickly that it will provide good feed for dairy cows or sheep in about eight weeks. Often it can be suitably sown immediately after

oats, and if sown in February provides feed at a time when it is often desired. Algerian oats are very useful for later sowing and later use. With all these crops it is usually profitable to apply superphosphate at 1 cwt. to 2 cwt. to the acre.

All crops sown in rows wide enough apart to allow of it call for summer intertillage at regular intervals as long as it is possible to work between the rows. It is impossible to safely say how often the intertillage should be carried out. On soils the surface of which is apt to cake a short heavy beating rain may so solidify the surface as to call for another cultivation, even though a cultivation had been carried out shortly prior to such a rain. The condition to aim at, especially in dry climates, is a continuously loose surface layer of soil.

Lucerne.

Lucerne may be sown with success in February in some districts. Good germination is favoured by the warmth which the soil then possesses. Further, the February-sown crop is likely to escape much of the trouble from certain weeds, such as fat-hen, which at times greatly handicap the establishment of a spring-sown crop. Where the grass-grub is present it is desirable that land to be sown with lucerne in February should have been free from grass or cereal growth during the previous summer period, when eggs of the grub were being deposited.

Young lucerne which was sown in November or December is often fit for mowing in February. It is better not to hasten the mowing, however, unless flowering has commenced or weeds are tending to choke the lucerne-plants, for the early stages of the crop can well be spent in building up sturdiness and a roomy root-system rather than in producing forage.

It is often profitable to top-dress lucerne with phosphates in summer. Top-dressing at this season is much preferable generally to top-dressing in the early spring, which is so often practised, and which is likely to stimulate invading grasses such as rye-grass and cocksfoot —the very plants it is desirable to suppress in the interest of lucerne.

Summer Weed-control.

During summer attention can often be given with profit (particularly by those with land under the plough) to certain important matters affecting weed-control. In the first place, certain crops such as mangels, swedes, and potatoes, which are sown in rows wide enough apart to admit of intertillage, have been called " cleaning " crops, because of the possibilities they provide of getting rid of weed infestation. It is highly desirable that these crops be made " cleaning " in fact as well as in name. Too often they are cleaning-crops in name only, because once the main invasion of weeds has been eliminated little attention is given to succeeding invasions, which, even if they do not seriously lessen the yield of the crop, are usually quite sufficient in numbers to foul the land badly if they are allowed to produce seed. February is a time when there is often neglect in this respect.

At times, and particularly in the South Island, weed infestation should be considered when future cropping is being planned. For instance, land may be known to be foul with annual weeds such as fat-hen, spurrey (yarr), and night-shade, which germinate in the spring rather than at other times. Cropping should be arranged so that such land will be sown in the autumn rather than in the spring. The influence of the date of sowing on weed-control is well exemplified when wheat is grown on land infested with fat-hen seeds ; the fat-hen will not be much in evidence in autumn-sown wheat, whereas it is likely to be prominent in and to seriously affect the returns from spring-sown wheat. Again, turnips or spring-sown oats may be almost completely ruined by spurrey, whereas autumn-sown oats or temporary pasture on the same land may be expected not to be seriously affected by this weed. It is well to bear in mind, further, that if trouble from annual

weeds is avoided for one season, in the manner just mentioned, the land does not, merely on that account, become free from weed-seeds; the seeds of certain weeds, among which are fat-hen and spurrey, are capable of continuing alive and vigorous even when buried in the ground for many years. Because of this, land on which seeds of such weeds occur in profusion should be kept in pasture (if the pasture is a satisfactory one) as long as requirements do not call for its being put under the plough.

There is another aspect of weed-control calling for consideration at the present season. It has to do with summer fallowing, which was once generally recommended as a standard means of weed-extermination. Except under the conditions most favourable to it, which are not of wide occurrence, it is now being dispensed with, because it is impracticable as a sole means of destroying weeds difficult to deal with. The summer fallow was usually adopted against weeds of the "twitchy" type, such as sorrel, couch-grass, yarrow, brown-top, creeping fog, and Californian thistle. It is now accepted that, while summer fallow may at times eradicate weeds of this type, the method requires so much labour as to become too expensive; and, further, under many conditions, no matter how much labour were devoted to summer fallow, by itself it would not be effective.

This is not to say that summer cultivation is useless in weed-destruction. The position is that to obtain its full potential value it must be linked with other suitable measures of management—measures which continue to exert on the perennial twitchy weeds a weakening influence similar to that exerted by the cultivation. For instance, summer cultivation during a dry period should be followed by the immediate sowing of a crop which grows quickly and densely. These crops have a smothering effect by excluding direct sunlight, which is a vital necessity to practically all weeds. At times autumn-sown Algerian oats, or Western Wolths rye-grass and red clover, prove suitable for this purpose. If after such crops the weeds still call for attention it can often be given effectively by growing a well-tended, well-nourished forage crop such as mangels, turnips, rape, or chou moellier. In brief, a suitable rotation which is spread over a number of seasons, and which all the time pays its way, rather than expensive summer fallow, is the modern method of perennial-weed eradication.

Another point often overlooked in regard to weed-control is that soil the surface of which is badly infested with weed-seeds, having been ploughed, should then be so cultivated that the buried former surface layer is not again brought to the surface. Weed-seeds buried to a depth of some inches, while they may not be destroyed, will be dormant, and so long as they remain dormant they are of no moment to the farmer. This point is of considerable importance in planning cropping programmes in which crops such as mangels, lucerne, and carrots figure. These crops are specially apt to suffer badly from weed infestation, and ploughing for them should be planned with this point in mind.

Often direct attack on weeds such as sorrel, brown-top, creeping fog, and similar "twitchy" plants is not advisable. The best mode of dealing with them is often to sow the land in grass, and by judicious manuring and management to make the conditions so favourable to growth of grass that the grass gradually smothers the weeds to such an extent that their presence is not felt.

The matters in regard to weed-control calling for attention at the present season, summed up, are (1) the taking of proper steps to make "cleaning" crops true to name; (2) the adoption of a suitable rotation rather than summer fallow to eradicate perennial weeds; (3) the autumn sowing of land infested with spring-germinating weed-seeds; (4) care not to bring to the surface a crop of weed-seeds that has been buried deeply; (5) the attacking of certain weeds indirectly by making the conditions so favourable for valuable plants that these latter smother the weeds.

—*R. P. Connell, M.A., Fields Division, Palmerston North.*

THE ORCHARD.

Spraying.

CODLIN-MOTH control measures must be continued during the coming month, but with varieties approaching picking consideration must be given to the possibility of spray residue being in excess of the export tolerance, or remaining in sufficient quantities to detract from the appearance of the fruit for local market. A flight of moth may be expected early in January, necessitating another lead spray. To spray or not to spray is a question that always confronts the grower as the crop approaches maturity, and the decision must be with the individual orchardist, after due consideration of the length of time prior to picking, weather conditions, prevalence or otherwise of black-spot, &c. The omission of spreader and Black Leaf will assist in reducing the amount of deposit, and if a combination lime-sulphur and lead is used any excess of lime should be avoided.

Apples and pears will be kept under close observation, particularly during humid spells following showers, for the first appearance of fresh black-spot, either on foliage or fruit, and if circumstances permit a spray should be applied immediately. Where powdery mildew is in evidence precipitated sulphur at 10 lb. or 12 lb. per hundred gallons will be required, and should not be neglected, for this disease may seriously debilitate the tree, making the production of satisfactory crops impossible. Another arsenate-of-lead spraying may be necessary for leech.

Silver-blight (silver-leaf) infection in stone-fruits should receive attention during the early summer months. Removing the infected limbs during the growing season simplifies the detection of the disease and increases the possibility of recovery where the infection is slight. Innumerable weird and fantastic remedies or cures for silver-blight have been given publicity from time to time in all parts of the fruitgrowing world, but so far nothing has proved superior to the removal of the infected portion. Isolated cases occur where trees recover without treatment, but they are the exceptions, and where the infection is general it is advisable to dig up and burn all infected material before the spores are liberated to infect surrounding trees. The three summer months are considered to be the period of least susceptibility, and during that time the upward flow of sap tends to form a gum barrier under the exposed surface and retard or prevent reinfection. After any cutting-out operations precautions should be taken against infection from spores, which appear to be always present in the atmosphere. For this purpose any good lead paint or grafting-wax will be suitable. Similar steps should be taken with limbs which have split or broken through heavy cropping, and timely attention may be the means of saving the tree.

Picking for Export.

Export picking will soon commence in earnest, and once started there is no easing up until the season is finished. Each season seems to find some grower short of necessary requisites, and annoying delays, sometimes detrimental to the fruit, are often caused through lost stamps, damaged wiring-machines, or repairs to equipment which should have received attention during the off season. Delays in picking consequent on shortage of orchard cases are frequent causes of damaged fruit. In their efforts to maintain a fair daily average pickers will be tempted to remove the fruit and empty the picking-bags with more haste than discretion, and the size of the cull heap will tell its own tale. Not infrequently it is possible to locate the pickers from a distance by the rattle of the fruit being shot out of the bags into the cases, and as many more bumps are inflicted before the fruit reaches the consumer it is not surprising that it does not always open up in the best condition. The successful organization of an orchard

team is often no small undertaking, and the practice of making each picker chalk a distinguishing mark on each of his cases as they are filled helps to eliminate slipshod methods and place credit where it is due. The picker carries a responsibility that is not fully appreciated, and any one lacking aptitude should be transferred to another job.

Just what stage of development and what conditions to look for as an indication of the correct degree of maturity for storage purposes are always perplexing questions, which can only be satisfactorily decided by familiarizing oneself with the individual variety and its peculiarities. If the requisite degree of maturity has not been reached, certain chemical changes which cannot continue after the fruit has been picked will be arrested, and the result will be an insipid specimen of sponge-like texture. On the other hand, if allowed to remain on the tree until fully ripe the fruit, having a definite length of life, has reached its zenith, and with the decline its storage life is correspondingly shortened. Of the apparent changes which take place none can be relied on individually. The development of the red in coloured varieties and the fading of the green to yellow in others may be accelerated or retarded by unfavourable weather conditions. The pips may be quite brown while the juice is milky, indicating that the transformation of starch to sugar has not advanced sufficiently and consequently that flavour is lacking. The degree of resistance in removing the fruit from the spur is governed by the progress of the formation of the abscessial layer (a growth of tissue between the stem and the spur, designed to check further development and facilitate the transference of the seed to its natural element), and if the fruit with stem intact does not separate readily it is obvious that picking should be delayed.

Taken collectively these conditions can give a fairly accurate indication of the progress of maturity, and where quality and flavour are the first consideration picking should not commence until some flavour is noticeable, but before any softening takes place, otherwise the keeping-qualities will be sacrificed. To ensure making an even line several pickings are necessary, usually the tops of the trees and the more exposed portions providing the first fruit, the remainder ripening at a slower rate. It is important that fruit should be dry when picked, and picked fruit should be stacked in the shade to hasten colouring.

Grafted Trees and Budding.

Grafts will now have attained some size, and may need staking as a protection against March gales. Undesirable shoots may be pinched out to shape the tree, and adventitious growths coming from the stock may be gradually removed. Where grafts have missed, buds may be inserted in a suitably placed sucker.

Budding may be pushed on while the stocks are active. If dry weather has prematurely checked the sap-flow, rendering the bark hard and difficult to lift, it may be advisable to delay the operation until early rains stimulate growth prior to leaf-fall. Last year's buds may be shortened to a desirable height to induce branching. Peaches and nectarines will make a considerable amount of growth from now on, and if the leading shoots are pinched back occasionally to check the growth a better type of wood will be produced.

Cultivation and Cover Crops.

Growth will be reaching a stage where in many places cultivation will have to be suspended. While the land is in good physical condition it is sound practice to take advantage of the good tilth and sow a cover-crop, either for grazing off or ploughing in with the spring cultivation. Continued clean cultivation is not in the best interests of the land, for the time must come when, through the depletion of the humus content and the attendant changes in the nature of the soil, fertility is reduced, full value

is not received from the application of artificial manures, and there is a corresponding decrease in the vitality and productivity of the trees. The choice of cover-crops will be governed by the ultimate requirements and the nature of the land. Leguminous crops are generally preferable, and where a large bulk of matter is required blue lupins find most favour. Other suitable crops are oats and vetches, field-peas, cape barley, and mustard.

Summer Pruning.

While impracticable in most mixed commercial orchards, summer pruning can often be advantageously resorted to during the midsummer period. Pinching back the strong shoots and thinning out the weedy undesirable or crowded growth will assist in promoting better development of the permanent wood and the fruit-buds for next season's crop.

Citrus-culture.

As fruit reaches picking size it should be harvested to reduce the strain on the trees. With the driest period of the year approaching every assistance should be given to the trees to maintain their vigour, for anything approaching drought conditions may produce wilting, defoliation, dropping of fruit, and inability to continue growth with the advent of autumn rains. Frequent surface stirring will aid materially in conserving moisture and eradicating weeds which compete with the trees for the available moisture. Mulching with any suitable material will assist in keeping the surface cool and retard evaporation.

Young trees will be benefited by occasional inspections to suppress any undesirable shoots while they are soft, particularly those which arise from the lower part of the stem and develop into secondary leaders. Too little attention is usually given to laying in the foundation limbs of young lemon-trees, and in later years the trouble cannot be rectified without sacrificing valuable fruiting-wood. As opportunity offers bark-diseases should receive attention, and any injuries inflicted during cultural operations should be painted over. Very frequently these injuries provide entry for fungus organisms, and the infection area may become extensive before the effect is apparent.

—G. H. McIndoe, Orchard Instructor, Gisborne.

POULTRY-KEEPING.

Priming the Cockerels.

Now that the young stock are developing at a rapid rate the demand for housing accommodation will be increasing daily, with the possible risk of the birds becoming overcrowded. To lessen the risk of this and its evil effects, particularly on the growing birds, the necessity for priming-off all forward cockerels must be emphasized. Even when food is cheap it is false economy to keep a cockerel after it is about five months old, but with food at its present high price a bird may easily show a loss instead of a profit. Another point to be remembered is that the flesh of a prime five-months-old bird is distinctly superior to that of one double that age, and will therefore command a much higher price and give a better return over the cost of production. The great advantage, however, in weeding out cockerels at an early age is that accommodation and runs are saved, which is distinctly to the advantage of the remaining stock, while more time is available to attend to the main working of the plant.

It is a mistake to endeavour to prime cockerels when they are running with the pullets; the males should be separated from the females before they commence to crow. Nor should one try to prime cockerels on inferior

or damaged food; if they are to lay on flesh rapidly the food should be sound and fed with a free hand. The birds should be confined in small runs with little scope for exercise, and only soft food should be given, as hard grains are apt to bring on digestive troubles when the birds are confined to a limited space. A suitable mash may be made from two parts of bran and one part each of finely ground wheat-meal and maize-meal, the whole being moistened with milk or soup and mixed into a crumbly mash. Feed three times a day as much as the birds will eat up clean. Succulent green food can be fed in abundance, but separately, and where skim-milk is available it may be given in large quantities for drinking.

High Perches and Foot Troubles.

It is often difficult to impress the fact that it is a mistake to have perches in the house unduly high, and that to compel birds to roost on high perches is one of the chief causes of disorders of the feet, especially corns. It is argued that when a fowl is allowed its freedom to roost where it likes it will fly into high trees and come down again without injuring its feet. The fact is overlooked that out in the open the bird can spread itself in a natural manner, and is therefore able to land gently on the ground, running as it alights to break the force of landing. In the fowlhouse, on the other hand, the bird loses all the advantage of its wings in its descent, and on reaching the ground the whole weight of its body has to be borne by the legs.

The hard landing not only has the effect of injuring the feet, but also has a detrimental effect on the high-type layer in the flush of her laying-period. Every care should also be taken to prevent breeding-pen cocks from contracting corns, as generally if they become affected in this way a high percentage of infertile eggs will be the result. While high perches and a hard floor to alight on are frequently a reason for corns, it must not be inferred that a floor such as concrete is a mistake from a health point of view. Concrete is an ideal flooring-material, but the perches should not be higher than 15 in., and there should be ample litter to provide a soft landing-place when the bird is alighting from the perch. When a bird becomes affected with a corn and is considered to be of sufficient value to receive personal attention, painting with iodine is a simple and often effective treatment. Another method is to treat with a bluestone solution. Dissolve a piece of bluestone about the size of a walnut in half a pint of hot water, and when the solution is cool dip the affected foot into it, repeating this treatment daily for a week or more.

Many poultry-keepers lance the foot immediately a corn is detected. This is not only a cruel practice, but it seldom has the desired effect. The corn or abscess should not be interfered with until it has reached a perfectly ripe condition, and at this stage it will probably make its appearance between the toes as well as on the ball of the foot. From these places the dry pus can be easily picked out by means of a small-bladed penknife. After this operation a few drops of peroxide of hydrogen may be dropped into the affected parts. In order to keep the wound clean the foot should be bandaged and kept soft with vaseline or a similar preparation. The bird should not be allowed to perch, and should be provided with soft bedding until a cure is effected.

As is the case with most troubles affecting poultry, the best method of dealing with corns and other disorders of the feet is to prevent them, the chief essentials for which are low perches, a well-littered floor, and eliminating undue pressure on the feet by keeping the birds as far as possible from running on hard stony ground.

Marking Chickens.

Poultry-keepers should on no account fail to mark the young stock as a future guide to age, in order to distinguish the young birds from the old

ones when culling is necessary, which is the case every season if only profitable birds are to be retained. There are practically no definite means of telling the age of a bird by its general appearance. Perhaps the simplest method of marking birds is to punch a hole in the web of the foot, keeping a particular section of the web of each bird for the particular season. It should be remembered that even in the best of flocks the egg returns from the second-season birds are at least 30 per cent. lower than from the pullets, while the cost of production is just the same; and the yield decreases more rapidly after the second year. This necessary detail should therefore not be delayed. It is the only safe means of obviating the common mistake of sending a young profitable bird to market and retaining an old and unprofitable one. A punch for the purpose can be obtained at a moderate price. With this instrument the young birds can be marked at an early age, or even when leaving the incubator. For marking fully developed birds, rings, as commonly used in a pig's nose to keep it from rooting, are quite effective. These are obtainable in both the round and flat form. They may be easily put on the leg of a fowl with a pair of closing-pincers as used for ringing a pig, and when once on there is little or no chance of them falling off. For pedigree breeding the flat rings may be numbered by means of a small set of steel numbering punches.

Hens losing Feathers from Back.

A correspondent asks for advice regarding some of his hens losing the feathers from their backs. This condition is found only where the hens are running with male birds. It need not cause any anxiety, as the bare places will soon feather over when the cocks are removed from the pen. It is always the best layers which become the worst affected in this way, and particularly where the birds are overmated on the male side, or the latter are specially vigorous.

Now that the breeding-season is over the importance of separating the breeding-males from the females must be strongly emphasized. More eggs will be produced without the males, while from all points of view the separation will be to the advantage of the females.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Extracting Operations.

If the bees have received adequate attention, and have been supplied with sufficient super-accommodation, there should be some honey fit for extracting before the end of January. At that time there will still be a flow of honey, however, and consequently more or less unripe honey in the hives. It will therefore be necessary to make a point of seeing that any combs taken from the hive for extracting purposes are sealed.

Escape-boards are sometimes a convenience in taking off honey for extracting. Boards made for the greater part of wire cloth are preferable, as they permit of the warmth from the bees rising to the honey; such boards are obtainable from dealers in beekeepers' supplies. It will be necessary to see that there is no brood in the combs above the escape-board; the bees will not go down if any of the combs contain brood. If the boards are inserted late in the afternoon all the bees will have gone down to the brood-chamber before the following morning, and the honey can be taken off without disturbing them.

When taking off honey keep a sharp lookout for signs of foul-brood. The honey from diseased colonies should not be put through the extractor until all other extracting is finished. The combs from infected colonies should be destroyed after the honey has been extracted.

As previously mentioned, the beekeeper should make sure that the honey is well ripened before removing it. The usual method of removal is to take out the combs one by one, giving each comb a sharp shake to dislodge as many bees as possible, and then each side a light brushing to remove those remaining. The frame of honey is then placed in an empty super or hive-body on the barrow, and taken to the honey-house. This method allows the combs to be examined, so as to reject any containing brood. But where queen-excluders have been in use the plan is usually to remove the queen-excluder the previous evening, slipping in its place a bee-escape board.

When sufficient honey has been removed to keep the extractor going for some time it is advisable to commence operations at once, while the honey is warm. Nearly all up-to-date apiaries are now equipped with a steam-heated uncapping-knife and capping-melters. There is no doubt that the use of these greatly facilitates the work of extracting.

Provision should be made to allow the honey to run from the extractor or pump through a strainer before it reaches the tank. It is a good plan to have a fairly coarse strainer on top to catch the larger particles of wax, and beneath it a finer one. For the lower one cheese-cloth answers the purpose very well. These strainers should be removed when necessary and washed in cold water, then given a good shake to remove the small particles of wax, and allowed to dry before again using.

From the strainer the honey should be run into tanks in order to allow it to settle, and the small bubbles of air and particles of wax that have escaped the strainer to rise to the surface. These should be skimmed off as they accumulate. The size of the tanks is a matter for the beekeeper's opinion, but the tendency now is to have deeper tanks sufficiently large to hold at least one day's extracting. The honey should be left in these for two or three days if the weather is good. Should the weather become damp during extracting the tanks should be kept covered so as to prevent the honey taking up moisture from the damp air. If it is found that the honey on the top is becoming thin it is advisable to skim this off and put it aside. No such honey should be put in packages for the market, otherwise it will probably mean a considerable loss, owing to fermentation setting up through the excessive moisture.

Most beekeepers who have only a few colonies will make use of existing buildings for extracting. It will be necessary, however, to select a building that can be made bee-proof. In apiary work, as well as in all other occupations requiring the handling of foodstuffs, the question of cleanliness must not be lost sight of. Everything in the honey-house should be kept scrupulously clean. The extractor and tanks should be scalded out previous to being used, and as soon as the day's work of extracting is done they should be covered with covers made for the purpose so as to keep out all dust, &c.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

The Tobacco Crop.

THE early crop of tobacco will now, four weeks or so after topping, be approaching maturity, and will soon be ready for harvesting. Ripe leaf slightly droops, is brittle, and mottled with light-green and yellow spots, first on the lower leaves and then spreading to the leaves above them on the stalk.

Where air-curing on the stalk is practised the plants should be cut as soon as the middle leaves are ripe, as these are the more valuable. There should be no delay; every day gained is an advantage, as the warm, dry weather at this season makes a first-rate cure a comparatively easy matter. When this stage is reached the only legitimate cause for delay is wet

weather, as if the plants are cut under or shortly after such conditions the aromatic qualities of the leaf are at a discount. In fine weather, then, as soon as the dew has dried off the leaves, the ripe plants should be harvested by splitting the stalk to within a few inches of the ground and then cutting it off at the base of the plant. The plants are then threaded on the curing-sticks about 6 in. apart and carted to the drying-shed in which they are hung for curing. While awaiting removal they are best hung on a couple of parallel poles on trestles. There they wilt without danger of sun-burning, and will afterwards be handled with less danger of being torn or sweating unduly. Every care should be taken to avoid tearing or bruising the leaf, as such damage is irreparable.

As splitting the stalks has resulted in moulds sometimes developing on the cut surfaces, more especially in humid weather and later in the season, it is now usually the custom to cut the plants off at the surface of the ground, tie the butts of the stalks of the two plants together, and then hang them across the curing-stick. Another alternative method that has the advantage of requiring less shed accommodation is to gather the leaves separately as they ripen. When the bottom three or four leaves are ripe the harvesters break them from the stalk and carefully lay them on trays or a stretcher taken down between the rows, each person gathering the leaves from two rows of plants. These are carried out and tied to the curing-sticks with a cheap cotton twine. The leaves are tied in bunches of twos or threes, according to size, by taking a turn round the butts of the mid-ribs with the string and giving them a twist, which leaves them hanging securely first on one side of the stick and then on the other at intervals of 2 in. to 3 in. At the end of the stick the string is tied and broken off; the stick of leaf is then ready for hanging in the curing-shed. The middle leaves and tops are gathered as they ripen. In a well-managed shed this classification is maintained, and half the work of grading the leaf is thus done in harvesting. In the shed the sticks of leaf should hang without touching either those below or the sticks alongside. Careless spacing is a very common fault. It delays the cure, and is often so bad as to cause pole-burn.

Under the warm humid conditions which develop in the shed the leaf first turns a yellow colour, and when this is properly developed it should be thoroughly dried off without delay by increasing ventilation during dry periods. After it has dried out to the extent that the thicker parts of the midrib of the leaf are brittle it should be conditioned by exposing it to a humid atmosphere. It then absorbs moisture and becomes soft and pliable. As soon as this condition is reached it should be properly bulked down in a suitable room. To leave cured leaf hanging in the shed to become alternately dry and moist is bad economy, as it is occupying badly needed space and becoming depreciated in colour and texture, as well as inviting the development of mould along the midrib.

When the separate-leaf system of harvesting is adopted the material may be bulked on the sticks as it is, taking care to maintain the classification of lugs, middle leaves, and tops. Where whole plants are cured the leaves must be stripped from the stalks as soon as they are in condition after drying, and tied into hands of fifteen to twenty leaves, according to the thickness of the midribs. These hands of leaf should then be bulked. When stripping, the leaves should be classified into lugs, middle leaves, and tops, as a preliminary to closer grading, which will require to be done later.

Tomatoes.

Towards the end of February, when the crop of tomatoes under glass has been gathered, the old plants should be lifted and taken out and burnt, for if they remain neglected fungus and insect pests are bred, and infection, which is difficult to remove, develops. When the plants are removed, give light cultivation, and sow the land down in white mustard for a quick cover-

crop, to be followed by another of oats and peas, or by a crop of winter salads or beans. Sometimes a portion of the space is devoted to seed-beds of lettuce, cabbage, cauliflower, &c., for planting out in early spring.

The tomato crop outside will now be maturing, and packing and marketing the crop will keep all hands busy. Standard packing and a system that will ensure even and regular distribution is badly needed. All growers should carefully study these problems now so as to assist their organization to make the requisite improvements. Good progress in this direction was made at the last annual conference of growers, and careful study of problems as they arise this season should enable members to assist in maintaining progress when the opportunities arise in the conference to be held during the coming winter.

Small-fruits.

The suggestions made last month for the treatment of the small-fruit section should still be given attention. Where farm manures are scarce a green crop of white mustard or rape between the rows of raspberries and larger bush-fruits may now be sown with great benefit.

In the South Island strawberries should be planted as early as possible, so as to enable the plants to become established before growth ceases. A piece of land that has been thoroughly manured and cleaned with a crop of early vegetables is very suitable for the purpose. In the North, where the one-season cropping system is practised, the plants are set out 9 in. to 12 in. apart with 24 in. to 27 in. between the rows. But for three to four years' cropping the spacing is usually wider, such as 12 in. to 18 in. between the plants and 30 in. to 36 in. between the rows. Plant firmly in land that is well consolidated.

Land to be planted out into bush fruits is now probably carrying a vegetable crop. Such land should receive special attention with a view to cleaning it well, including the headlands. It will then be clean and in good heart for planting in the month of May.

Market-garden Work.

Many good crops of potatoes and onions are spoiled in the operations of harvesting. This is done chiefly by leaving them in the ground for some time after they are mature, harvesting them in dull or showery weather, and storing them without grading out diseased and broken specimens. Most important is it that these valuable crops should be harvested in fine weather at the first opportunity after they reach maturity. If they are of a type and quality suitable for long storage all damaged and defective tubers or bulbs should be graded out, and the sound stock should be given good storage. For the storage of onions dry airy conditions are necessary, while for potatoes a clean, dark, cool, humid storeroom is best. For a while considerable moisture is given off when the produce is stored, and ample ventilation is necessary to dispose of it.

Important sowings in the coming month are cabbage for spring cutting and shorthorn carrots for lifting in the spring when the main crop is about used up; also spinach and turnips.

Close attention must be given to spraying the celery crop as required, for fungus and insect pests are often found attacking these plants.

The Home Garden.

In the South Island the present time is most suitable for sowing down new lawns. Supposing the land to be clean and well cultivated, it should now be rolled when the soil is comparatively dry, and the surface raked smooth. This should be repeated until the surface is even in every respect; the seeds should then be sown and raked in.

—W. C. Hyde, Horticulturist, Wellington.

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR DECEMBER, 1929.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Dominion Colirina ..	Ruakura Farm of Instruction, Hamilton	2 15	242·0	365	10,376·3	579·01
Woodlands Felicie ..	P. J. Petersen, Waitara ..	2 10	241·5	365	8,265·6	550·54
Ferncrest Aster ..	W. J. Paul, Toatoa ..	1 340	240·5	365	8,010·7	517·38
Pari Climber ..	F. C. Butt, Opotiki ..	2 10	241·5	365	9,934·1	512·82
Velebit Flower* ..	G. E. Yelchich, Waiuku ..	2 21	242·	303	7,800·1	509·27
Oaklands Charming ..	F. W. Cornwall, Bell Block	2 20	242·5	365	6,572·5	460·88
Lisbury Miss Superior	M. A. Jennings, Mauriceville	2 26	243·1	365	8,770·2	433·51
Jersey Meadows Sunflower	H. H. Phillips, Te Rehunga	1 328	240·5	365	7,078·6	423·29
Pinewoods Golden Heather	G. H. Bell, Oakura ..	1 311	240·5	345	7,079·0	410·10
Squire's Iris ..	H. H. Phillips, Te Rehunga	2 0	240·5	365	7,513·3	402·32
Leno's Fawn Beauty	T. and A. Smith, Otorohanga	2 17	242·2	365	6,419·0	397·14
Pari Dawn ..	F. C. Butt, Opotiki ..	2 12	241·7	365	7,011·3	392·02
Holly Oak Sungleam	F. Parsons, Patea ..	2 0	240·5	365	6,608·0	386·08
Glencoe Diamond ..	J. M. Clarke, Maunu ..	2 32	243·7	344	6,250·2	383·21
Volunteer's Ruby ..	G. H. Bell, Oakura ..	1 289	240·5	364	6,798·0	380·85
Stirling Dusk ..	J. A. Moffat, Turiwiri ..	2 32	243·7	365	6,096·5	378·83
Pinewoods Golden Tresses	G. H. Bell, Oakura ..	1 320	240·5	305	5,462·7	368·62
Stirling Lady ..	J. A. Moffat, Turiwiri ..	2 43	244·8	365	6,312·1	367·01
Pari Patch ..	F. C. Butt, Opotiki ..	2 15	242·0	365	7,205·6	363·89
Roslyn Eva ..	A. J. Harris, Bombay ..	2 3	240·8	348	6,799·3	322·69
Mangaraupi Lassie ..	E. A. Harrington, Hukanui	2 84	248·9	307	6,069·4	310·91
Glad News ..	T. E. Churches, Awakino Pt.	1 312	240·5	365	5,345·9	309·98
Wyndale Georgina ..	J. M. Clarke, Maunu ..	2 24	242·9	282	5,874·6	308·41
Corra Lynn Sunshine	A. Best, Bombay ..	2 2	240·7	365	5,723·0	297·78
Roslyn Exile ..	A. J. Harris, Bombay ..	2 27	243·2	322	5,204·1	296·55
Glenview Delightment	L. R. Fuller, Greenmeadows	1 312	240·5	365	5,230·0	278·08
Senior Two-year-old.						
Igatpuri Morlena ..	C. G. Stuart, Rockville ..	2 311	271·6	365	8,787·3	566·79
Dominion Decoration	Ruakura Farm, Hamilton	2 278	268·3	365	9,235·6	507·95
Dominion Gaysome Beauty	Ruakura Farm, Hamilton	2 356	276·1	257	6,309·4	368·34
Three-year-old.						
Princess Mermaid* ..	G. E. Yelchich, Waiuku ..	3 361	313·1	365	15,481·5	829·63
Dominion Edna ..	Ruakura Farm, Hamilton	3 5	277·5	365	9,588·4	576·51
Holly Oak Rosette ..	Dr. C. G. Aickin, Auckland	3 360	313·0	329	9,295·4	497·70
Glenwillow Lassie ..	W. Raymond Campbell, Matakana	3 349	311·9	365	9,937·0	497·37
Dominion Miro ..	Ruakura Farm, Hamilton	3 279	304·9	357	8,149·9	493·94
Dominion Rosary ..	Ruakura Farm, Hamilton	3 23	279·3	322	8,900·8	454·36
Mount Kowhai Eileen	R. J. Johnston, Runciman	3 89	285·9	365	7,673·6	406·32
Tyntesfield Zeala ..	R. K. Garland, Okauia ..	3 5	277·5	331	6,544·2	370·93
Sunshine Beauty ..	E. A. Harrington, Hukanui	3 49	281·9	309	7,435·7	326·75

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		JERSEYS—*continued*				
Four-year-old.		Yrs. dys.	lb.		lb.	lb.
Eaton Birdie ..	A. O. Brown, Kamo ..	4 32	316·7	365	12,002·4	734·67
Orange Dale Madeline	Estate of W. J. Hall and Son, Matatoki	4 4	313·9	365	10,360·2	631·05
Lyvondale Duchess Karaka	G. R. and H. Hutchinson, Auckland	4 56	319·1	365	11,928·1	572·97
Dominion Golden Fancy	Ruakura Farm, Hamilton	4 350	348·5	346	11,865·8	555·55
Brooklyn Lavinia ..	H. J. Lancaster, Glen Oroua	4 36	317·1	311	9,572·2	499·46
Bonwin of Lyndale ..	Mrs. E. E. Norton, Waimauku	4 54	318·9	365	8,591·0	445·96
Majesty Swan's Girlie	Mrs. V. A. McIlveen, Taupaki	4 22	315·7	295	7,785·8	420·01
Ebors Agnes ..	R. J. Wilson, Putaruru ..	4 342	347·7	305	8,495·1	372·94
Mature.						
Beechlands Preference	A. Moreland and Sons, Te Rapa	7 50	350·0	365	15,540·3	847·49
Pride's Golden Hope	R. E. Clements, Awakino Point	6 287	350·0	365	10,997·4	647·60
Glen Willow Girlie ..	W. Raymond Campbell, Matakana	5, 78	350·0	357	11,529·4	633·12
Dominion Coral ..	Ruakura Farm, Hamilton	5 338	350·0	365	11,583·9	611·63
Lakeside Tilly ..	W. J. Paul, Toatoa ..	7 320	350·0	365	10,939·8	577·50
Jersey Brae Princess Mary	T. Brownlee, Pukekohe ..	7 67	350·0	365	9,912·3	554·87
Royton Dark Beauty	A. R. Clark, Hamilton ..	7 157	350·0	348	10,689·0	553·04
Memoir	W. Raymond Campbell, Matakana	7 340	350·0	365	11,446·0	538·79
Tauwhare Daisy ..	Dr. C. G. Aickin, Auckland	5 41	350·0	357	8,775·4	531·04
Wairua Carlysle ..	A. L. Dermer, Feilding ..	7 14	350·0	365	9,906·7	530·82
Orange Dale Guava ..	Estate of W. J. Hall and Son, Matatoki	5 344	350·0	338	9,025·9	521·76
Fransiska	A. L. Dermer, Feilding ..	10 6	350·0	365	8,421·9	511·67
Pilot's Gem ..	T. Brownlee, Pukekohe ..	9 46	350·0	365	8,314·5	507·62
Awa Silver Princess	J. A. Blake, Waipawa ..	5 81	350·0	339	8,915·7	492·85
Vernon Cherry Bloom	G. R. and H. Hutchinson, Auckland	6 24	350·0	288	9,356·5	488·57
Beechlands Violette	A. Moreland and Sons, Te Rapa	10 265	350·0	341	9,872·0	425·09
St. Aubin's Aster ..	J. G. Harvey, Taupiri ..	12 195	350·0	309	7,284·1	414·23
Omagh Beauty ..	R. K. Garland, Okauia ..	6 37	350·0	336	8,557·6	408·79
Silverleys Nita ..	F. Parsons, Patea ..	5 20	350·0	334	7,576·7	404·66
Vicella	T. Foreman, Alton ..	8 45	350·0	323	7,654·4	375·83
Carmen Sylva ..	W. J. Paul, Toatoa ..	5 17	350·0	298	7,322·8	359·47
	FRIESIANS.					
Junior Two-year-old.						
Hobson W.S.P. Zozo†	W. H. Madill, Auckland ..	2 165	257·0	365	15,500·1	531·31
Glenmore Pietje Pride*	H. Johnson and Son, Stratford	2 2	240·7	365	14,570·7	522·46
Pareora Burke Park*	A. S. Elworthy, Timaru ..	2 9	241·4	365	16,146·6	518·74
Hobson Princess Pontiac II†	W. H. Madill, Auckland ..	2 172	257·7	365	16,299·0	514·14
Hobson Acme Mercedes†	W. H. Madill, Auckland ..	2 155	256·0	365	14,416·5	505·37
Oakview Primrose Hengerveld†	Oakview Stud Farm, Auckland	2 20	242·5	352	13,771·0	420·74
Wescoll Diamond* ..	Wesley Training College, Paerata	2 120	252·5	365	8,510·4	262·70

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS—*continued.*					
		Yrs. dys.	lb.		lb.	lb.
Junior Three-year-old						
Patchwork Domino of Oakview†	Oakview Stud Farm, Paerata	360	283·0	365	17,061·7	531·78
Senior Three-year-old.						
Totara Pontiac Countess†	Piri Land Co., Auckland ..	3 246	301·6	365	16,414·6	610·57
Sunbank Woodcrest Colantha	J. Urquhart, Invercargill ..	3 324	309·4	296	13,127·3	477·61
Sunbank Woodcrest Ruby	J. Urquhart, Invercargill ..	3 320	309·0	319	16,520·0	472·56
Senior Four-year-old.						
Merrylea Inka May Griselda*	F. J. McDonald, Waitati ..	4 292	342·7	365	18,398·1	684·35
Mature.						
Dutchland Makanui of Oakview†	Oakview Stud Farm, Auckland	8 47	350·0	365	21,556·2	754·72
Glenmore Tilly Alcartra*	H. Johnson and Son, Stratford	7 262	350·0	365	18,192·7	639·18
Cluny Pietje Brundee*	Piri Land Co., Auckland ..	5 195	350·0	365	17,630·9	605·78
Murihiku Woodcrest Pearl	J. Urquhart, Invercargill ..	5 361	350·0	291	13,495·3	396·84
	MILKING SHORTHORNS.					
Senior Two-year-old.						
Dominion Athlea of Ruakura	Ruakura Farm, Hamilton	2 360	276·5	349	11,674·8	537·93
Hauruia Queen† ..	A. L. Souter and Son, Waerenga	2 332	273·7	313	8,481·2	379·79
Senior Four-year-old.						
Dominion Arabis of Ruakura	Ruakura Farm, Hamilton	4 305	344·0	348	8,285·4	353·95
Mature.						
Dominion Alsatian of Ruakura	Ruakura Farm, Hamilton	5 338	350·0	343	11,894·5	534·31
Dominion Lola of Ruakura	Ruakura Farm, Hamilton	5 331	350·0	365	13,218·5	514·58
Dominion Jacaranda of Ruakura	Ruakura Farm, Hamilton	6 11	350·0	300	11,610·5	513·48
Cairnbank Young Lady	W. J. Cooper, Rapanui ..	5 5	350·0	321	9,676·8	399·07
	AYRSHIRES.					
Mature.						
Glengyle Mountain Maid	Mrs. J. H. Winter, Invercargill	5 37	350·0	365	12,204·9	439·74
	GUERNSEYS.					
Three-year-old.						
Dominion Flora's Pride	Rukura Farm, Hamilton	3 361	313·1	365	10,339·4	593·29

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	Second-class Certificates.					
	Jerseys.					
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Orange Dale Raindrop	Estate of W. J. Hall and Son, Matatoki	1 318	240·5	365	8,242·4	442·33
Brookley Sunshine ..	E. W. Jacobs, Horotiu ..	1 349	240·5	338	7,599·5	424·05
Three-year-old.						
Runnymead Baby ..	T. and A. Smith, Otorohanga	3 361	313·1	365	10,463·4	558·93
Mature.						
Beechlands Queen ..	A. Moreland and Sons, Te Rapa	7 338	350·0	365	10,918·9	624·72
Eureka Majestic ..	W. T. Luxton, Hamilton ..	8 297	350·0	365	8,382·7	466·09
	Friesians.					
Mature.						
Mahoe Adiantum ..	R. A. Wilson, Bulls ..	6 0	350·0	365	19,230·1	664·84
	Ayrshires.					
Two-year-old.						
Dominion Carol ..	Ruakura Farm, Hamilton	2 336	274·1	365	11,591·5	529·35

—*Dairy Division.*

CERTIFICATION OF RYE-GRASS SEED.

List of Growers and Registered Areas, Season 1929–30.

Printed below is a list of growers who are harvesting seed from areas which are now registered as fit for the production of perennial rye-grass seed of the "Certified Permanent Pasture" class. A full account of the organization of the certification of rye-grass was published in this *Journal* for November, 1929. Reprints of this article are available on application to the Fields Superintendents in the several centres.

The following points are of particular importance in connection with the publication of this list:—

(1) The pastures enumerated below are in the meantime registered as fit for the production of "Permanent Pasture" seed—that is, the rye-grass is of the correct type and the stands are five years old or over, but no sample trial report is available which would render them fit for the production of "Mother" seed.

(2) As soon as possible after harvest a sample from each line will be placed under trial at the Plant Research Station, Palmerston North, and reported upon within three or four months—that is, before seed is usually sown in the South Island.

(3) If the report indicates that the seed is equal to the standard of Mother seed, the parties concerned will be notified. The seed will be recorded as Mother seed, and the first harvest progeny of that seed will be eligible for certification subject to a field inspection.

(4) Should the seed on trial prove not to be up to the standard of Mother seed it will have to be considered still as Permanent Pasture seed.

Every endeavour has been made to avoid such a possibility, and the standard has been kept very high. However, a small percentage is likely to be ineligible as Mother seed, and allowance must be made in this connection.

(5) The main difference between the grower who sows down Mother seed as compared with one who sows down Permanent Pasture seed is that the first harvest progeny of Mother seed is eligible for certification (subject to a field inspection), whereas the first harvest progeny of Permanent Pasture seed is not eligible under any condition whatsoever.

(6) Since white-clover seed from five-year-old stands is eligible for certification as "New Zealand White Clover, Certified Old Pasture," it follows that any white clover dressed out of the rye-grass seed harvested on these areas will be eligible for certification.

Growers of Certified Permanent Pasture Rye-grass.

Name.	Address.	Total Area.
	Hawke's Bay District.	Acres.
Allen, A. W.	Tomoana	42
Allen, J. L.	Twyford	29
Anderson, F. W.	Twyford	4
Apperley, J.	Norton Road, Hastings	9
Bridgman, S. G.	Haumoana	16
Burge, A. J.	Twyford	7
Burge, H. W.	Twyford	5
Burns, H. H.	Twyford	73
Burns, W. F. M.	Richmond Road, Hastings	12
Burgess, T.	Meeanee	29
Clarke, H. A. R.	Waiohika	25
Crawford, H.	Havelock North	10
Couper, E. D.	Te Mata, Havelock North	40
Currie, T.	Twyford	13
Elliott, D. S.	Haumoana	34
Estate (A. McLean)	Twyford	41
Estate (M. Wellwood)	Raureka	26
Fernie, D.	Chesterhope, Pakowhai	90
Frogley, R.	Mangateretere	25
Frost, G.	Twyford	11
Gregory, R.	Clive	12
Griffiths, R.	Twyford	23
Gimblett, W. J.	Ngatarawa	7
Haldane, C.	Raureka	48
Hickson, A.	Hills Road, Fernhill	14
Harris, J. H.	Haumoana	30
Harris, J. H.	Hastings	9
Heeney, Mrs.	Mahora North	32
Hall, J.	Pakowhai Road, Hastings	2
Hope, J.	Omahu Road, Hastings	11
Lascelles, P. W.	Mangateretere	50
Lister, H. H.	Clive	14
Loughnan, C.	Otane	7
Macdonald Bros.	Havelock North	10
Milne, C. W.	Mangateretere	8
Miller, Max	Pakowhai	7
Merrit, Mrs.	Pakowhai Road, Hastings	15
McLeod, H.	Raupare	50
Macdonald, James	Meeanee	144
McLeod, W.	Paki Paki	8
MacNamara, D.	Pakowhai Road, Hastings	2
Masters, A. J.	Twyford	49
McNab, J. A., jun.	Twyford	5
McNab. J., sen.	Twyford	12

Growers of Certified Permanent Pasture Rye-grass—continued.

Name.	Address.	Total Area.
	Hawke's Bay District—continued.	Acres
Parsons, P.	Meeanee	49
Percival, T. S.	Mahora North	44
Person, Mrs.	Hills Road, Fernhill	6
Pickering and Hackett	Waiohika	10
Robertson, J.	Haumoana	38
Ramsay Bros.	Haumoana	14
Rosser, C.	Paki Paki	83
Rule, H.	Raupare	17
Stewart, H. N.	Haumoana	71
Stead, W. G.	Flaxmere, Raupare	62
Simson, E. M.	Tomoana	40
Smith, A. H.	Poukawa	17
Speers, A.	Longlands	12
Speers, G. J.	Paki Paki	10
Struthers, A.	Longlands	25
Struthers, J.	Pukahu	35
Symes, A. F. M.	Longlands	67
Taha Otene	Tomoana	23
Tattersall, C. E.	Pakowhai	69
Tait, T.	Twyford	10
Tod, R. H.	Otane	25
Thompson, H.	Paki Paki	16
Thompson, J. B.	Mahora North	31
van Asch, W.	Craggy Range, Tuki Tuki	103
Wall, H. A	Havelock North	18
Wall, W. J.	Karamu and Paki Paki	27
Wellwood, J.	Raureka	19
Wellwood, R. A.	York Road, Mahora South	28
Westcott, F.	Waiohika	7
Wright and Wallace	Hastings	8
	Total acreage	2,094
	Poverty Bay District.	
Baird, W.	Waerenga-a-hika	106
Bolton, V. S.	Waerenga-a-hika	30
Cray's Estate	Hexton	14
Hamon, Mrs. H.	Waerenga-a-hika	28
Habgood, F.	Patutahi	25
Jones, F. R.	Ormond	9
Mullan, B. P.	Waerenga-a-hika	10
Reynolds, G. M.	Ormond	51
	Total acreage	273
	Sandon District.	
Collier, F. S.	Sanson	16
Grand total acreage		2,383

—*J. W. Hadfield, Agronomist, Plant Research Station, Palmerston North.*

Noxious Weeds Order.—The Coromandel County Council has declared cut-leaved psorolea (*Psorolea pinata*) to be a noxious weed within that county.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

GRASS-ESTABLISHMENT ON FERN COUNTRY.

W. G. J., Hangatiki :—

Will you please give me a mixture for grass-seed to sow on fern country in this district. Would you advise cropping first, or would results be just as good by just ploughing and putting grass straight in ?

The Fields Division :—

Fern land is best broken in by first sowing the land in a temporary pasture of 20 lb. of Italian rye-grass and 5 lb. red clover. The fern should be burnt in the summer, the land ploughed, and the temporary pasture sown in March or early April. Bracken-fern, after remaining practically dormant over the winter, will invade the pasture again in the following spring. The fern comes through the ground in a soft curl, and if this is broken off no further growth will take place from the growing-point giving rise to the frond. The soft curled fronds will appear in October–November, and the pasture should then be heavily stocked with cattle for short intervals, so that the heavy treading of the cattle will break off the soft fronds. Temporary pastures are generally more satisfactory than permanent ones for breaking in fern, as they throw more feed during the first year and can consequently be more heavily stocked. Fern cannot be properly controlled if roots are taken as the first crop, as the fern re-establishes during the summer before the roots are ready to feed off.

DESTRUCTION OF MINT.

J. M., Bay View :—

I should be glad of advice regarding the destruction of mint, of which I have about an acre. I ploughed it up with great difficulty—the roots being like a mat, all intertwined—in June, let it lie all winter, cultivated it as well as I could in the spring, and sowed beans and maize. The mint is as thick as ever. I also drained part of the land.

The Horticulture Division :—

To destroy the mint at the present season it should be ploughed moderately deep and cut up well with disk harrows, following up this treatment with repeated cultivation and harrowing during fine weather. As soon as autumn rains set in the land should be sown down thickly in a cover-crop, such as blue lupins or oats and tares. If there is much growth of mint on the area at the present time it should be cut and carted off to rot before the ploughing is done.

TREATMENT FOR LICE ON HORSE.

"Jock," Methven :—

Would you please inform me as to the best method of getting rid of lice on an old horse.

The Live-stock Division :—

The following treatment has been found very useful for lice on horses: Take 1 lb. of yellow soap, ½ pint kerosene, and 1 gallon water; cut up the soap into small pieces and boil until dissolved in the water; when cool enough for application to the horse, add the kerosene and keep the mixture well stirred during application. The mixture should be well scrubbed into the horse, and the procedure repeated in four or five days. The animal should be clipped all over, and then singed before the treatment is carried out.

WEATHER RECORDS: DECEMBER AND CALENDAR YEAR, 1929.

Dominion Meteorological Office.

GENERAL NOTES FOR DECEMBER.

DECEMBER was a wet and stormy month. Although eastern districts experienced some hot and sultry days, there was less than the average amount of sunshine, and temperatures were considerably below normal. The only considerable areas where rainfall was below the December average were in the northern half of the Auckland Peninsula, and in eastern portions of the North Island from Hawke's Bay to East Cape. Over all western districts and in the high country of the interior, precipitation was heavily in excess of the normal. Most of the stormy weather was associated with the passage of cyclone centres across the South Island. Gales from between north and west were experienced to the north of the centres, while to the south of them easterly or south-easterly winds prevailed. It was these latter which accounted, to a large extent, for the high rainfalls in Canterbury and Otago. Thunderstorms were rather frequent, and in many cases severe. A large proportion were accompanied by showers of hail A considerable amount of fog was reported from both northern and southern extremities of the Dominion.

As indicated above, the unusual frequency of cyclonic depressions which has characterized the past two years was fully maintained in December. Their movement was very rapid, and this was on the whole fortunate, since although there were numbers of cases of rivers reaching flood stage they usually receded just when serious floods appeared to be imminent, and the actual damage was slight.

The first of the cyclones referred to crossed the south-western extremity of the Dominion on the evening of the 4th to 5th, and caused boisterous weather. Rain was widespread, with many heavy falls, especially from Taranaki and Wellington southwards. On the 5th there were many thunderstorms.

From the 6th to the 9th weather of the westerly type prevailed. Squally winds blew from some westerly quarter, frequently reaching gale force, and western districts especially experienced showery weather.

The finest spell of weather during the month followed the westerly weather and persisted till the 15th. During this period a severe tropical cyclone developed in the Fiji Group and moved slowly away. On the night of the 11th and the morning of the 12th a heavy fog in Cook Strait caused delays to shipping.

On the 17th the second cyclone crossed southern Otago, and again northerly gales and almost general rain accompanied its passage. Thunderstorms were a marked feature of this cyclone during the whole time it was moving over the Tasman Sea and New Zealand.

A third cyclone traversed the Dominion on the 22nd, the centre this time crossing South Canterbury. Precipitation was again general, and the southerly winds in the rear of the depression brought particularly heavy rain to the eastern districts of the South Island. At Kaikoura the phenomenal fall of 3 in. in sixty-five minutes was registered. Thunder and hail storms were very violent and widespread in connection with this storm, especially on the 22nd.

The last of the month's cyclones moved over southern Otago on the 29th. Boisterous weather and almost general rain accompanied its passage. At Wellington over seventy miles per hour was registered in a northerly gale on the 29th.

Each of the cyclonic storms described was responsible for falls of snow on the ranges in the South Island, and a number of frosts occurred.

RAINFALL FOR DECEMBER AND CALENDAR YEAR, 1929, AT REPRESENTATIVE STATIONS.

No.	Station.	December, 1929				Calendar Year.	
		Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall, 1929.	Average Rainfall.
		North Island.					
		Inches.		Inches.	Inches.	Inches.	Inches.
1	Kaitaia	0·97	7	0·20	3·28	54·66	50·4
2	Russell	1·53	7	1·07	2·65	45·32	53·5
3	Whangarei ..	1·67	11	0·74	3·11	62·98	61·8
4	Auckland ..	3·93	20	1·18	2·84	51·52	45·0
5	Hamilton ..	4·57	18	1·49	3·72	48·98	52·3
5A	Rotorua	5·60	13	1·75	3·83	60·31	55·0
6	Kawhia	6·10	20	1·60	3·25	55·69	56·6
7	New Plymouth ..	6·87	21	1·48	4·33	60·13	60·0
8	Riversdale, Inglewood	12·35	23	2·57	7·43	88·30	103·8
9	Whangamomona ..	10·05	21	1·36	5·84	81·18	80·6
10	Eltham	6·74	16	1·15	3·83	58·91	52·9
11	Tairua	1·80	10	0·44	4·68	51·07	67·0
12	Tauranga ..	3·90	18	0·95	3·47	46·71	53·0
13	Maraehako Station	2·66	12	0·50	2·74	55·13	52·8
14	Gisborne ..	1·67	9	0·57	2·16	43·58	46·0
15	Taupo	3·22	15	1·06	3·36	42·83	46·8
16	Napier	1·09	9	0·29	2·30	28·58	35·0
17	Maraekakaho Station	1·56	15	0·26	2·21	33·09	35·3
18	Taihape	4·40	20	0·97	3·42	34·98	38·0
19	Masterton ..	3·71	16	0·89	2·80	32·60	39·0
20	Patea	5·09	16	0·90	3·67	*	44·3
21	Wanganui ..	4·54	11	0·80	2·63	32·95	36·9
22	Foxton	4·40	14	1·20	2·54	32·58	31·5
23	Wellington (Karori)	3·06	16	0·67	2·99	53·92	45·4
		South Island.					
24	Westport ..	12·83	29	2·24	6·60	75·13	79·5
25	Greymouth ..	13·58	23	1·90	8·56	94·91	102·0
26	Hokitika ..	19·75	25	3·23	10·70	109·80	115·0
27	Ross	21·84	24	3·18	12·04	136·65	136·9
28	Arthur's Pass ..	29·11	17	8·70	14·93	176·71	156·6
29	Okuru	15·71	17	1·86	11·73	119·12	149·7
30	Collingwood ..	10·81	19	2·47	8·01	*	97·9
31	Nelson	3·99	17	1·04	2·69	48·61	39·0
32	Spring Creek ..	2·89	17	0·55	2·04	37·99	30·6
33	Tophouse ..	11·21	23	1·64	5·66	79·38	61·9
34	Hanmer Springs ..	4·54	18	0·93	3·28	41·94	41·0
35	Highfield, Waiau ..	3·20	8	1·26	2·58	33·90	33·5
36	Gore Bay ..	1·96	11	0·96	2·77	29·02	31·2
37	Christchurch ..	3·40	19	1·98	2·06	23·56	25·0
38	Timaru	2·44	21	0·46	2·41	23·36	24·0
39	Lambrook Station..	5·10	17	0·72	2·58	32·24	25·8
40	Benmore Station ..	6·24	18	1·16	2·13	31·45	27·0
41	Oamaru	3·17	19	0·95	2·15	27·64	22·0
42	Queenstown ..	4·21	17	0·52	2·59	32·00	31·0
43	Clyde	2·50	12	0·44	1·79	15·38	14·9
44	Dunedin	5·94	23	0·42	3·48	41·96	37·0
45	Wendon	3·42	19	0·58	2·76	28·90	30·2
46	Gore	4·10	25	0·60	3·33	32·85	35·0
47	Invercargill ..	5·25	23	0·75	4·26	41·48	45·0
48	Puysegur Point ..	8·43	24	1·79	6·63	83·15	85·6
49	Half-moon Bay ..	5·77	22	0·75	5·69	56·21	58·7

* Incomplete.

—*Edward Kidson, Director of Meteorological Services, Wellington, 7/1/30.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 14th November to 31st December, 1929, include the following of agricultural interest:—

No. 61062: Manure distributor; J. Munro, Lochiel. No. 62461: Caseindrying; J. Pasquier, A. Meese, and R. L. Billiez, Joue-les-Tours, France. No. 62913: Hay-handling apparatus; J. P. McLeod, Ashburton. No. 63071: Milking-machine; Aktiebolaget Separator, Stockholm, Sweden (also Nos. 63842 and 63843). No. 63557: Milk treatment; J. O. and N. V. Hickman, Rickmansworth, England. No. 63609: Beef-chilling rack; Swift and Co., Chicago, U.S.A. No. 63699: Wool-scouring; L. A. and A. E. Bowler, Geelong, Victoria. No. 63226: Fertilizer; W. C. Gentles, New Plymouth. No. 63684: Hay-press; R. S. Whicher, Elaine, Victoria. No. 63767: Milking-machine; Stuart Turner, Ltd., Henley-on-Thames, England. No. 63792: Grass-cutting; W. C. D. Dampier-Whetham and T. B. Wood, Cambridge, England. No. 61945: Animal trap; F. G. Carr, Sydney, N.S.W. No. 62080: Tine harrow; E. W. Poole, Dannevirke. No. 62098: Milking-machine pulsator; R. P. Houghton, Hamilton. No. 63411: Cheese; S. H. Hartmann, Melbourne, Victoria. No. 63713: Manure-distributor; J. G. Clark, Ohura. No. 63850: Harrow; K. V. Henrikson, Tatuanui. No. 63856: Hay-stacker; Newton King, Ltd., New Plymouth. No. 61899: Milk-protector; W. F. Hussey, Ohakune. No. 61937: Teat-cup support; C. F. Leonards, Waharoa. No. 62067: Teat-cup; A. B. Robertson, Hamilton. No. 62256: Separator for milk, A. E. Denham (nominee), Wellington. No. 63279: Milking-machine; J. Taylor and Co., Ltd., Eltham. No. 63891: Seed-treatment; Warren-Teed Seed Co., Chicago, U.S.A. No. 63982: Triple Superphosphate; F. C. P. and F. Palazzo, Florence, Italy. No. 63984: Dicalcium phosphate and nitrate; F. C. P. and F. Palazzo, Florence, Italy.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. prepaid.

FORTHCOMING AGRICULTURAL SHOWS.

THE following show-dates have been notified by agricultural and pastoral associations:—

Helensville A. and P. Association: Helensville, 29th January.
Opotiki A. and P. Association: Opotiki, 1st February.
Feilding A. and P. Association: Feilding, 4th and 5th February.
Whakatane A. and P. Association: Whakatane, 5th February.
King Country A. and P. Association: Te Kuiti, 6th February.
Rodney Agricultural Society: Warkworth, 8th February.
Te Puke A. and P. Association: Te Puke, 8th February.
Dannevirke A. and P. Association: Dannevirke, 11th and 12th February.
Tauranga A. and P. Association, Tauranga, 11th and 12th February.
Franklin A. and P. Association: Pukekohe, 14th and 15th February.
Buller A. and P. Association: Westport, 14th and 15th February.
Masterton A. and P. Association: Solway, 18th and 19th February.
Katikati A. and P. Society: Katikati, 19th February.
Marton A. and P. Association: Marton, 26th February.
Auckland A. and P. Association: Auckland, 27th February to 1st March.
Taranaki Agricultural Society: New Plymouth, 5th and 6th March.
Waikato Central Agricultural Association: Cambridge, 5th and 6th March.
Morrinsville A. and P. Society: Morrinsville, 12th March.
Hawke's Bay A. and P. Society: Autumn Show, Tomoana, 19th March.
Methven A. and P. Association: Methven, 29th March.
Oxford A. and P. Association: Oxford, 3rd April.

Tokaanu Soils Map.—In the article on the Soils of Tokaanu published in the December issue of the *Journal* the scale of miles was inadvertently omitted from the map. The scale is slightly less than 1 mile to the inch: 1 inch = 0·903 mile.